COLLINS

instruction book

Cedar Rapids Region | Collins Radio Company, Cedar Rapids, Iowa

51V-5
Glide Slope Receiver

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(C) Item or symbol number obtained from parts list or schematic
(D) Collins type number, name and serial number of principal equipment
(E) Unit subassembly number (where applicable)

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Glide Slope Receiver

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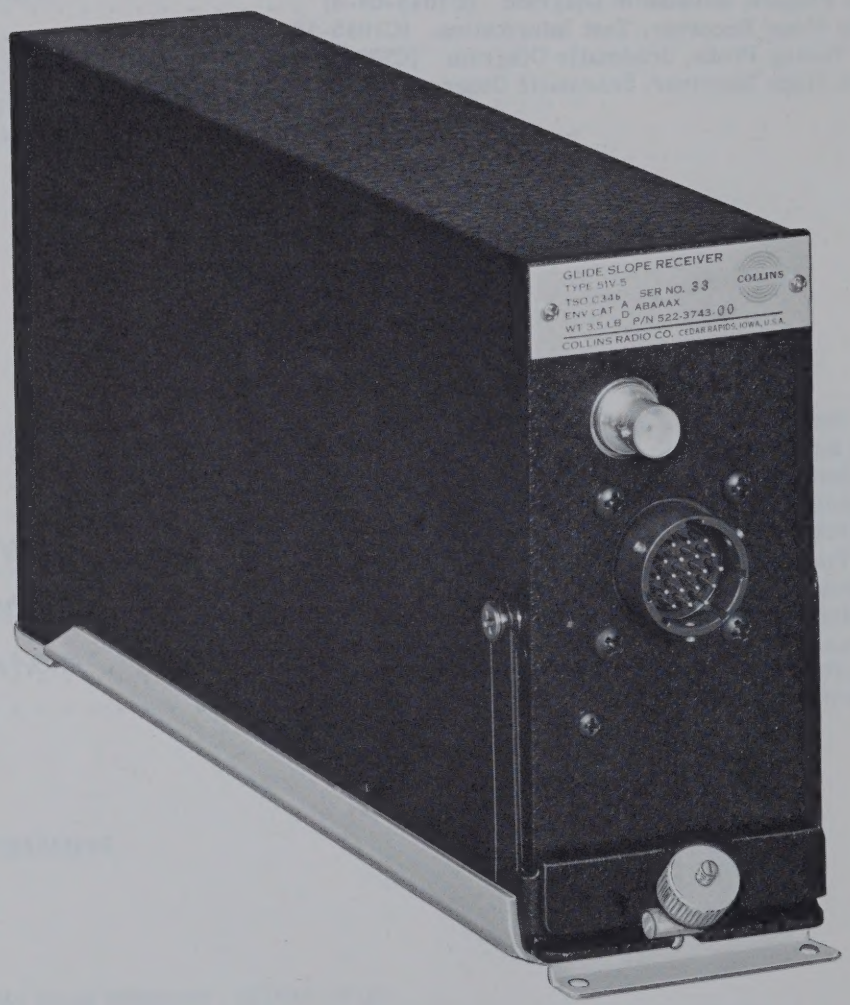


Figure 1-1. 51V-5 Glide Slope Receiver

section 1

general description

1.1 Purpose of Instruction Book.

This instruction book contains complete instructions for the installation, operation, and maintenance of the 51V-5 Glide Slope Receiver (Collins part number 522-2743-00). Also included is a theory of operation of the 51V-5 to provide maintenance personnel with a practical understanding of the operation of the 51V-5. All replaceable electrical parts used in the 51V-5 are identified and described in the parts list section. The 51V-5 is shown in figure 1-1.

1.2 Purpose of Equipment.

The 51V-5 is an airborne instrument approach equipment. It is used with appropriate indicators to give vertical guidance to a pilot during landings. The 51V-5 is used with a localizer and a marker beacon receiver to form a complete instrument approach receiver system.

1.3 Description.

1.3.1 ELECTRICAL DESCRIPTION.

The 51V-5 is a completely solid-state, 20-channel receiver covering the frequency range of 329.3 mc to 335.0 mc in 0.3-mc steps. Wide-band injection and r-f filtering are used to cover the entire frequency range. Standard 2-out-of-5 wire control system and pairing is used to operate a solid-state switching circuit in the 51V-5.

1.3.2 MECHANICAL DESCRIPTION.

The 51V-5 Glide Slope Receiver consists of a frame, front panel, and one-piece dust cover and is equipped with a rigid mounting device. All electrical components are mounted on the frame and point-to-point wiring is employed throughout. A handle is provided on the front panel. The 51V-5 is 12-3/16 inches long by 2-1/2 inches wide by 5-9/32 inches high and weighs 3.5 pounds including mount. All electrical connections to the 51V-5 are made through a type BNC antenna jack and type SP02A-14-19P connector located on the front panel.

1.4 Specifications.

Specifications for the 51V-5 Glide Slope Receiver are given in table 1-1.

1.5 Associated Equipment.

A complete instrument approach system requires a localizer receiver, glide slope receiver, marker beacon receiver, and appropriate indicators and controls. A list of associated equipment is given in table 1-2.

1.6 Other Publications Available.

Publications covering equipment associated with the 51V-5 are listed in table 1-3.

TABLE 1-1. EQUIPMENT SPECIFICATIONS

CHARACTERISTIC	SPECIFICATION
FAA TSO compliance	TSO-C34b.
Environmental categories	
Temperature - altitude	A and D.
Humidity	A.
Vibration	Category B of category A.
A-f magnetic field susceptibility	A.
R-f susceptibility	A.
R-f emission	A.
Explosion	X (not applicable).

TABLE 1-1. EQUIPMENT SPECIFICATIONS (Cont)

CHARACTERISTIC	SPECIFICATION
Power requirements	
Receive	27.5 +10%, -20% volts d-c 0.260 amp max.
Standby	27.5 volts d-c, 0.230 amp max.
Environmental service conditions	
Temperature	
Continuous operation	-54°C to +55°C (-65°F to +131°F).
Intermittent operation (30 minutes maximum)	Up to +71°C (+160°F).
Storage	-65°C to +71°C (-85°F to +160°F).
Humidity	95 to 100% for 48 hours at +50°C (+122°F).
Altitude	Up to 55,000 feet.
Shock (receiver in rigid mount)	6 g operate, 15 g impact.
Vibration (receiver in rigid mount)	0.02 in. double amplitude 5 to 55 cps with 3 g maximum, constant 1.5 g, 55 to 500 cps.
Frequency range	329.3 through 335.0 mc in 20 channels spaced at 0.3-mc intervals.
Selectivity (Bandwidth)	140 kc minimum at 6-db points, 450 kc maximum at 60-db points.
Sensitivity	Not more than 20-microvolt input with a 2-db audio ratio required to obtain a 47-microampere deflection (course sensitivity set at 78 microamperes deflection for standard glide slope deviation input).
Spurious response	At least 60 db down in the 0.09- to 1500-mc range.
Agc characteristic	Deviation output variation is within ±5% when input is increased from 700 to 14,000 microvolts.
Frequency stability	±0.01% under all service conditions, taken singly or together.
Navigation outputs	Six deviation indicator loads and five flag alarm indicator loads. 1250 uf deviation damping capacitor included internally.
Intermediate frequencies	30 mc and 3.1 mc.
Input circuit	Matches 52-ohm coaxial transmission line, vswr less than 10.

TABLE 1-2. ASSOCIATED EQUIPMENT

EQUIPMENT NOMENCLATURE	COLLINS PART NUMBER	NOTES
51R-7 VOR/LOC Receiver	522-2993-00	VOR/LOC receiver with manual instrumentation circuitry.
51R-8 VOR/LOC Receiver	522-3467-00	VOR/LOC receiver with manual instrumentation circuitry, 344F-2 automatic VOR instrumentation unit and RMI servo amplifier for magnetic compass servo amplification.
51R-8 VOR/LOC Receiver	522-3467-011	VOR/LOC receiver with manual instrumentation circuitry and 344F-2 automatic VOR instrumentation unit but with no RMI servo amplifier.
51Z-6 Marker Beacon Receiver	522-3876-001	Marker beacon receiver.
37P-4 Glide Slope Antenna	522-0688-013	Receives glide slope navigation signals for a single receiver.
37P-5 Glide Slope Antenna	522-0700-00	Receives glide slope navigation signals for two receivers.
331A-3G Course Selector Indicator	522-2638-00	Part of Collins PN-101 system.
331H-3G Course Selector Indicator	522-3306-00	Omnirange zeroed.
313N-1 Control Unit	522-2446-024	No audio potentiometer. Frequency range: 108.00 to 117.95 mc.
313N-2 Control Unit	522-2447-005	Frequency range: Comm 118.000 to 139.975 mc; Nav 108.00 to 117.95 mc.
313N-2 Control Unit	522-2447-015	Frequency range: Comm 116.000 to 149.975 mc; Nav 108.00 to 117.95 mc.
313N-2D Control Unit	522-2447-025	Frequency range: Comm 118.000 to 135.975 mc; Nav 108.00 to 117.95 mc plus 133.00 to 135.95 mc (DME extended range).
313N-2D Control Unit	522-2447-035	Frequency range: Comm 116.000 to 149.975 mc; Nav 108.00 to 117.95 mc plus 133.00 to 135.95 mc (DME extended range).
313N-3 Control Unit	522-2448-005	This unit is available without plastic front panel for custom installations. Frequency range: Comm 118.00 to 135.95 mc; Nav 108.00 to 117.95 mc.
313N-3 Control Unit	522-2448-015	Frequency range: Comm 118.00 to 135.95 mc; Nav 108.00 to 117.95 mc.

TABLE 1-2. ASSOCIATED EQUIPMENT (Cont)

EQUIPMENT NOMENCLATURE	COLLINS PART NUMBER	NOTES
313N-3D Control Unit	522-2448-025	Frequency range: Comm 118.00 to 135.95; Nav 108.00 to 117.95 mc plus 133.00 to 135.95 mc (DME extended range).
313N-3 Control Unit	522-2448-035	Frequency range: Comm 116.00 to 135.95 mc; Nav 108.00 to 117.95 mc.
313N-3 Control Unit	522-2448-045	Frequency range: Comm 116.00 to 149.95 mc; Nav 108.00 to 117.95 mc.
313N-3D Control Unit	522-2448-055	Frequency range: Comm 116.00 to 149.95 mc; Nav 108.00 to 117.95 mc plus 133.00 to 135.95 mc (DME extended range).
313N-3	522-2448-056	Frequency range: Comm 118.00 to 135.95 mc; Nav 108.00 to 117.95 mc.
313N-3D Control Unit	522-2448-057	Frequency range: Comm 116.00 to 149.95 mc; Nav 108.00 to 117.95 mc plus 133.00 to 135.95 mc (DME extended range).
313N-3D Control Unit	522-2448-058	Frequency range: Comm 118.00 to 135.95 mc; Nav 108.00 to 117.95 mc plus 133.00 to 135.95 mc (DME extended range).
313N-4B Control Unit	522-3614-00	Frequency range: 108.00 to 117.95 mc.
313N-4D Control Unit	522-3616-00	Frequency range: 108.00 to 117.95 mc plus 133.00 to 135.95 mc (DME extended range).

TABLE 1-3. OTHER PUBLICATIONS AVAILABLE

PUBLICATION	COLLINS PART NUMBER
51R-7/8 VOR/LOC Receiver Instruction Book	523-0756447
51Z-6 Marker Beacon Receiver Instruction Book	523-0757029
37P-2/3/4/5 Antenna Instruction Book	523-0755809
331H-3G Course Selector Indicator Instruction Book	523-0755935

TABLE 1-3. OTHER PUBLICATIONS AVAILABLE (Cont)

PUBLICATION	COLLINS PART NUMBER
PN-101 Pictorial-Symbolic Navigation System Instruction Book	523-0755824
PN-101 Pilot's Guide	523-0755801
313N-1 Control Unit Instruction Book	523-0722000
313N-2 Control Unit Instruction Book	523-0754001
313N-3 Control Unit Instruction Book	523-0752001
313N-4/4A/4B/4D Control Unit Instruction Book	523-0756631
313N-5/5A Control Unit Instruction Book	523-0756632

section 2

installation

2.1 General.

The 51V-5 Glide Slope Receiver requires no adjustment during flight, so it may be mounted in any convenient location. The antenna transmission lines should be as short as possible. The aircraft engine, ignition system, and generator should be bonded and shielded to prevent electrical interference.

2.2 Preinstallation Test.

Once the equipment has been unpacked and checked for visible shipping damage, it should be subjected to a preinstallation bench test. The 51V-5 is aligned and tested before leaving the factory, and no adjustments should be required unless repairs are made. The following procedure is intended to ensure correct operation of the 51V-5 when installed in an aircraft if the interconnecting wiring is installed correctly.

2.2.1 TEST EQUIPMENT REQUIRED.

Table 2-1 lists the test equipment required for the preinstallation checks of the 51V-5. If other test equipment is used, the test operator must be certain the substitute equipment is equivalent to that listed.

2.2.2 TEST FIXTURE.

The test fixture shown schematically in figure 7-1 is required for all bench testing and trouble shooting of the 51V-5. The fixture provides a channel selection switch, an input current milliammeter, a fuse, and jacks to accept test instrument plugs. A standard ARINC control box with 2-out-of-5 frequency selection may be substituted for the channel selection circuit used in the test fixture.

2.2.3 PROCEDURE.

If the 51V-5 fails to pass any of the tests presented in this section, refer to the maintenance section for alignment and trouble-shooting information.

a, Connect the equipment as shown in figure 5-1.

NOTE

The deviation and flag alarm outputs must be properly loaded to obtain correct test results. The flag and deviation meters called out in table 2-1 present a single 1000-ohm load. Refer to paragraph 2-5 and check that the proper dummy loads are connected.

b. Set the front panel controls on the Boonton 232-A as shown in table 2-2.

c. Channel the 51V-5 to 332.0 mc by selecting 109.3 mc on VHF control, if used, or by positioning switch S1 on test fixture to 332.0.

TABLE 2-1. PREINSTALLATION TEST EQUIPMENT

ITEM	IDENTIFICATION
Test fixture	To be fabricated locally (see figure 7-1).
Deviation meter	Weston 901, 150-0-150 ua, 1% accuracy, 1000 ohms ±5%.
Flag alarm meter	Weston 901, 500 ua, 1% accuracy, modified to 1000 ohms ±5%.
Glide slope signal generator	Boonton 232-A.
6-db pad (included with 232-A)	Boonton 506-B.
Output cable (included with 232-A)	Boonton 514-B.

TABLE 2-2. 232-A CONTROL SETTINGS

CONTROL	SETTING OR INDICATION
POWER ON/HEATER	POWER ON.
CARRIER	RF.
MOD	90-150.
FREQUENCY	332.0 MC.
OUTPUT LEVEL	700 uv.
CARRIER ADJUST	Red line on CARRIER MONITOR meter.
0-50%/0-100%	0-50%.
MOD LEVEL	40% each tone on PERCENT MODULATION meter (CAL position).
DB TONE RATIO	Refer to procedure.

d. Turn on the 27.5-volt d-c power supply and allow a 5-minute warmup period before proceeding with step e.

e. Place the DB TONE RATIO control at 2 (90 cps predominant). The deviation meter should indicate 78 microamperes.

f. Place the DB TONE RATIO control at 2 (150 cps predominant). The deviation meter should indicate 78 microamperes.

g. Place the DB TONE RATIO control at 0. The deviation meter should indicate 0 microampere, and the FLAG METER should indicate 350 microamperes.

h. Set the DB TONE RATIO control at CAL 90~. The flag meter should indicate no more than 200 microamperes.

i. Place the DB TONE RATIO control at 2.0 (90 cps predominant). Read and record the indication on the deviation meter.

j. Vary the OUTPUT LEVEL control from 700 uv through 14,000 uv. The deviation meter needle should not fall more than 4 ua below nor rise more than 4 ua above the value recorded in step i as the OUTPUT LEVEL control is varied.

k. Repeat step e for each of the 20 channels.

2.3 Mounting.

2.3.1 51V-5 GLIDE SLOPE RECEIVER MOUNTING.

The outline dimensions for the 51V-5 are shown in figure 2-1. The 51V-5 should be mounted in a cool dry location. A position near the floor of the aircraft is preferable. The antenna and the 51V-5 should be as close together as practical to avoid excessive loss in r-f cables. Consideration should also be given to keeping the distance to the control panel as short as possible to avoid interaction between long power, control, and indicator wires. The 51V-5 should be mounted so that it is accessible for maintenance, adjustment, and removal for trouble shooting. Accessibility should be subordinated to performance-affecting considerations if conflicting requirements exist. Shock mounting of the 51V-5 is not normally required. It is recommended that cooling space of 1/2 inch on each side and 1/2 inch at the front and back be provided, but this space is not an absolute requirement.

2.3.2 CONTROL UNIT MOUNTING.

The control unit may be mounted in any location that is easily accessible and visible to the pilot. The control unit need not be mounted in a vertical plate. The mounting information for the control unit is located in the related instruction book listed in table 1-3.

2.3.3 INDICATOR MOUNTING.

The deviation indicator should be mounted on the instrument panel within reach and in plain view of the pilot in a position which minimizes parallax. The mounting information for the indicator is located in the related instruction book listed in table 1-3.

2.3.4 ANTENNA MOUNTING.

The 37P-4/5 Glide Slope Antenna should be mounted within 30 degrees of horizontal on the nose of the aircraft with the antenna connector protruding through the skin of the aircraft. The 37P-4 antenna has a type N, UG-58/U receptacle and requires the use of a BNC-to-N adapter (Collins part number 357-9056-00). The 37P-5 Antenna has two type C connectors. Type RG-58/U coaxial cable should be used between the antenna and the connector of the 51V-5. This transmission cable should be kept as short as possible

and any bends in the cable should have at least a 3-inch radius. Other mounting information on the 37P-4/5 Antenna is located in the 37P-2/3/4/5 Instruction Book called out in table 1-3.

2.4 Cabling.

Representative VOR/ILS installations including the 51V-5 are shown in figures 2-2 and 2-3. The interconnection wiring diagram for these installations is shown in figures 2-4 and 2-5. All instructions given in the notes in the interconnection wiring diagram should be followed carefully. A listing of connector pin functions for the 51V-5 is given in table 2-3 for use when equipment other than that shown in figure 2-2 or 2-3 is used.

All cabling to a shockmounted unit should be long enough to avoid restricting the movement of the unit. All interconnecting wires except the antenna cables may be run to a junction box and then to the destination. The antenna cable should be run directly to the 51V-5 by the shortest possible route. The antenna cable should be isolated as much as possible from current carrying wires (power and control wires). Advantage should be taken of the shielding properties of the metal superstructure of the aircraft by routing the antenna cable (and other cables) behind or near these metal objects. If one 37P-4 Antenna is used to feed two receivers, special precautions in cable length must be observed to avoid partial or complete signal loss. The proper method of connection is to connect the cable from the antenna to a T-fitting and then connect the two receivers to the T-fitting with two cables that are equal in length and multiples of 12 inches. The length of the cable from the antenna to the T-fitting is not critical and may be any length that good wiring practice dictates. However, the T-fitting should be located as near the receivers as possible.

2.5 Loading.

As many as six 1000-ohm deviation indicators and five 1000-ohm flag alarm indicators may be driven by the 51V-5 by proper jumpering of internal dummy loads. Table 2-4 describes the dummy loads (R96, R79, and R102 for deviation; R103, R104, and R105 for flag) that must be connected in the deviation and flag output circuits under the various load conditions. Deviation dummy loads are connected in the deviation circuit by jumpering from the required loads to terminal E1. Flag dummy loads are connected in the flag circuit by jumpering from the required loads to terminal E2. Refer to figure 7-2 for the locations of the dummy loads and terminals. The 51V-5 is factory wired for one deviation and one flag load.

2.6 Postinstallation Ramp Check.

The following test procedure, using the Collins 479T-2 Ramp Test Set, is intended as a go-no-go test for the glide slope system including the antenna, control unit, indicators, and interconnecting wiring. If an abnormal indication is obtained, remove the 51V-5 and replace with a 51V-5 known to be in good operating condition. If the abnormal indication is again obtained, check the wiring and other system components.

TABLE 2-3
CONNECTOR PIN FUNCTIONS

TERMINAL	FUNCTION
A	1-mc, A wire, frequency select
B	1-mc, B wire, frequency select
D	1-mc, D wire, frequency select
E	1-mc, E wire, frequency select
F	0.1-mc, A wire, frequency select
G	0.1-mc, B wire, frequency select
J	Glide slope flag (+)
L	Glide slope on (ground)
M	+27.5 VDC
N	Ground
P	0.1-mc, E wire, frequency select
R	0.1-mc, D wire, frequency select
S	0.1-mc, C wire, frequency select
T	Glide slope deviation (+ up)
U	Glide slope flag (-)
V	Glide slope deviation (+ down)

a. Apply power to the glide slope system and select 109.3 mc on the control unit.

b. Apply power to the 479T-2 and set the 479T-2 near the aircraft in which the 51V-5 is installed. Ensure that the 479T-2 is calibrated.

c. Connect the 479T-2 antenna to the 479T-2 GS OUTPUT connector, and fully extend the antenna. Set the NAV-GS control to GS and the AUDIO SELECTOR to GLIDE SLOPE.

d. Set the 479T-2 METER switch to LINE, the SET LINE TO 21V switch to obtain a reading of 21 volts on the meter, the MICROVOLTS control to 200K, and the MEGACYCLES control to 109.3. Set the METER switch to CAR, and adjust the CARRIER SET control to obtain a red-line indication on the meter.

e. Set the LOC-GS control to UP. The glide slope deviation needle should deflect up, and the GS flag should be out of sight.

f. Set the LOC-GS control to DOWN. The glide slope deviation needle should deflect down.

g. Repeat step e for each ILS channel.

TABLE 2-4. REQUIRED DUMMY LOADS

NUMBER OF EXTERNAL LOADS	REQUIRED FLAG DUMMY LOADS	REQUIRED DEVIATION DUMMY LOADS
1	One 1000-ohm (R104). One 330-ohm (R105).	Two 1000-ohm (R96, R79). One 330-ohm (R102).
2	One 330-ohm (R105).	One 1000-ohm (R96). One 330-ohm (R102).
3	Two 1000-ohm (R104, R103).	One 330-ohm (R102).
4	One 1000-ohm (R104).	Two 1000-ohm (R96, R79).
5	No dummy loads.	One 1000-ohm (R96)
6	The 51V-5 cannot drive 6 flag alarm indicators.	No dummy loads.

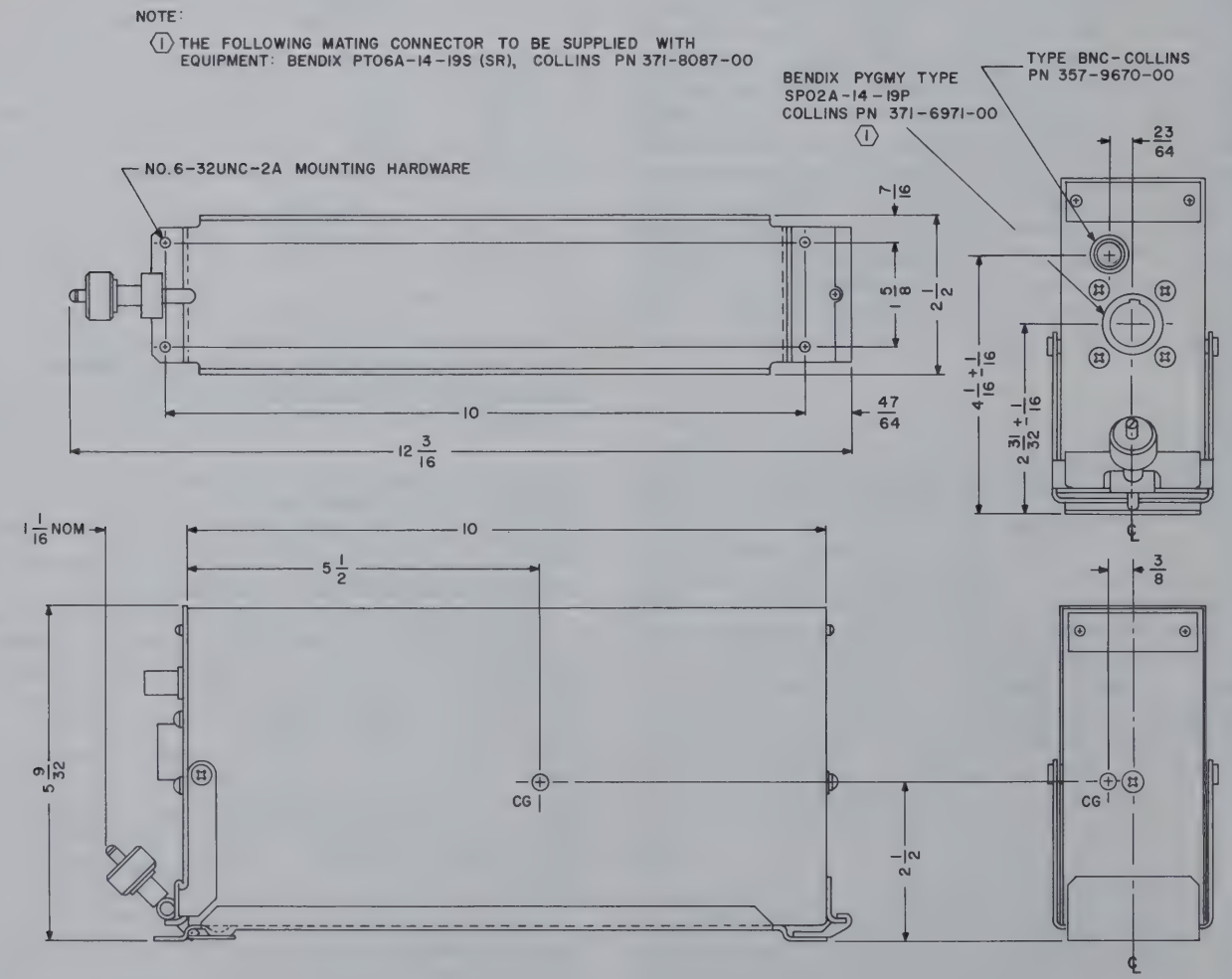


Figure 2-1. 51V-5 Glide Slope Receiver, Outline and Mounting Dimensions

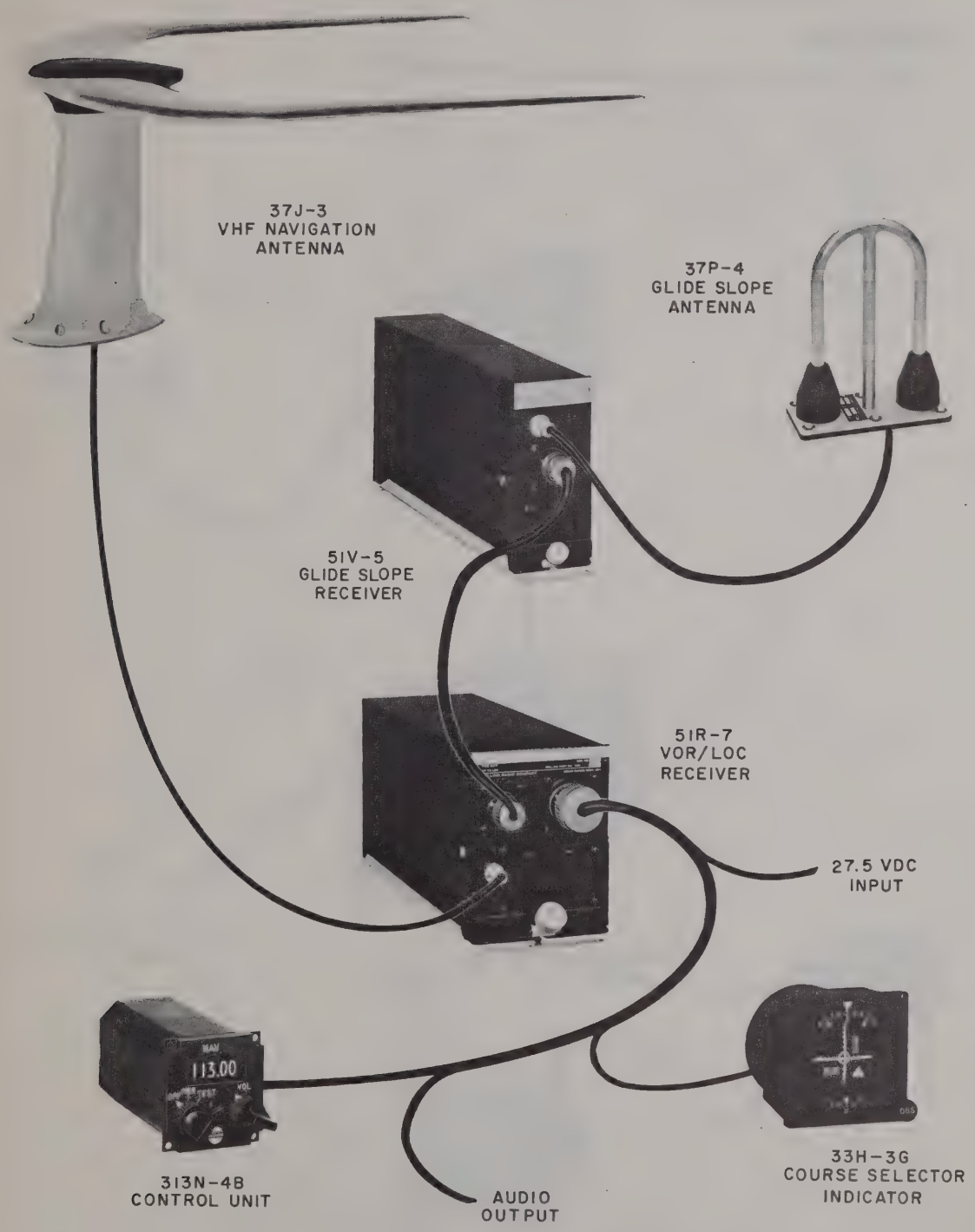


Figure 2-2. 51V-5/51R-7 VOR/ILS System

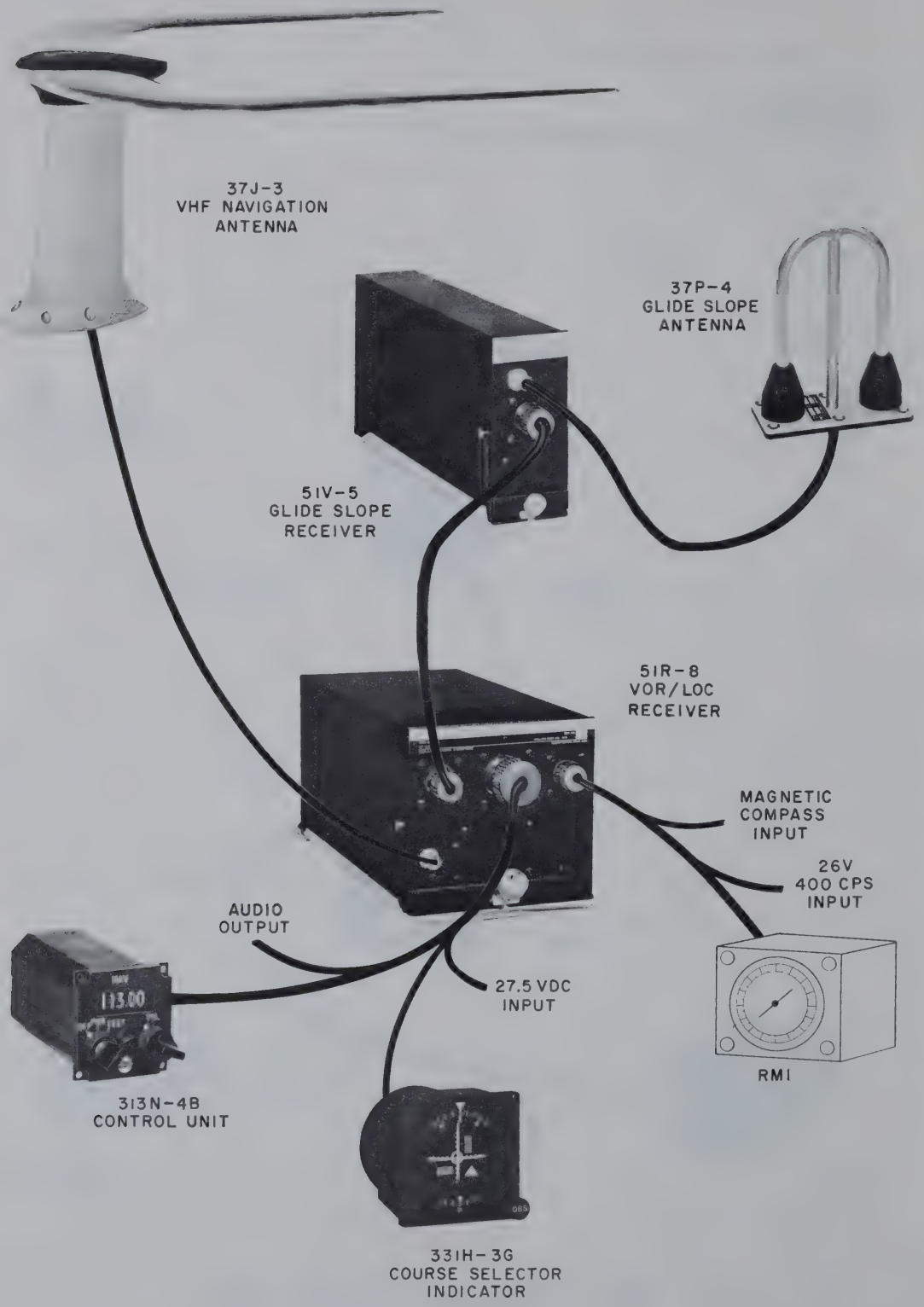


Figure 2-3. 51V-5/51R-8 VOR/ILS System

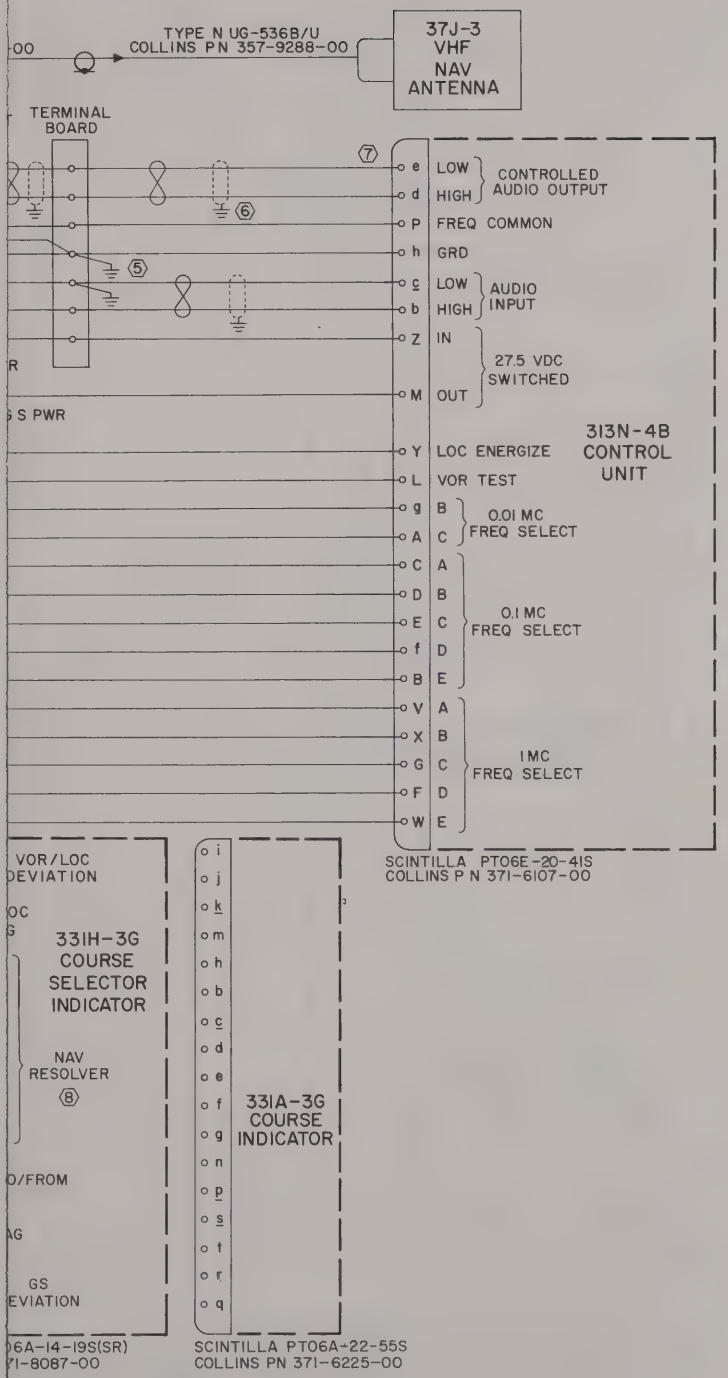


Figure 2-4. 51V-5/51R-7 Interconnecting Wiring Diagram

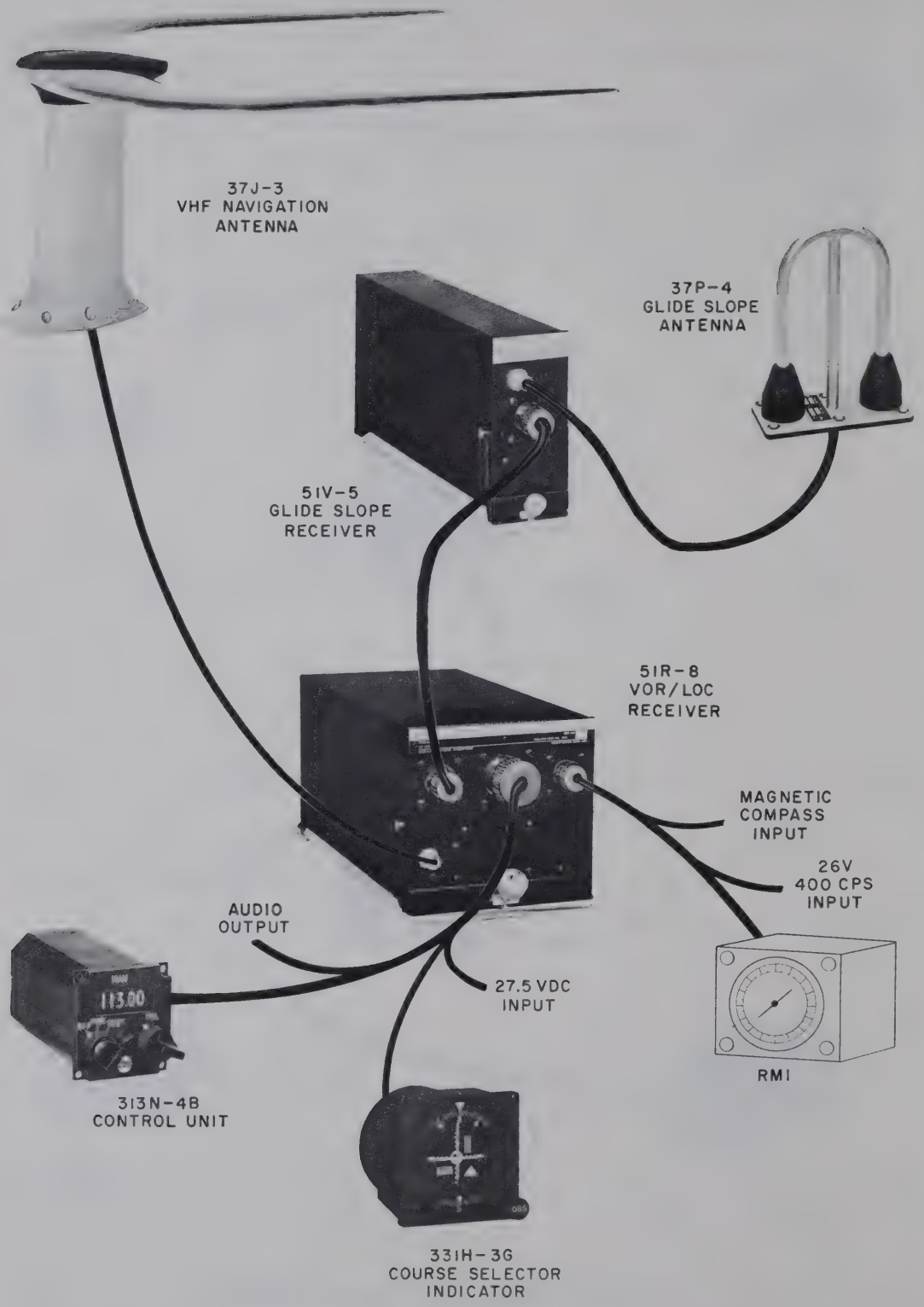
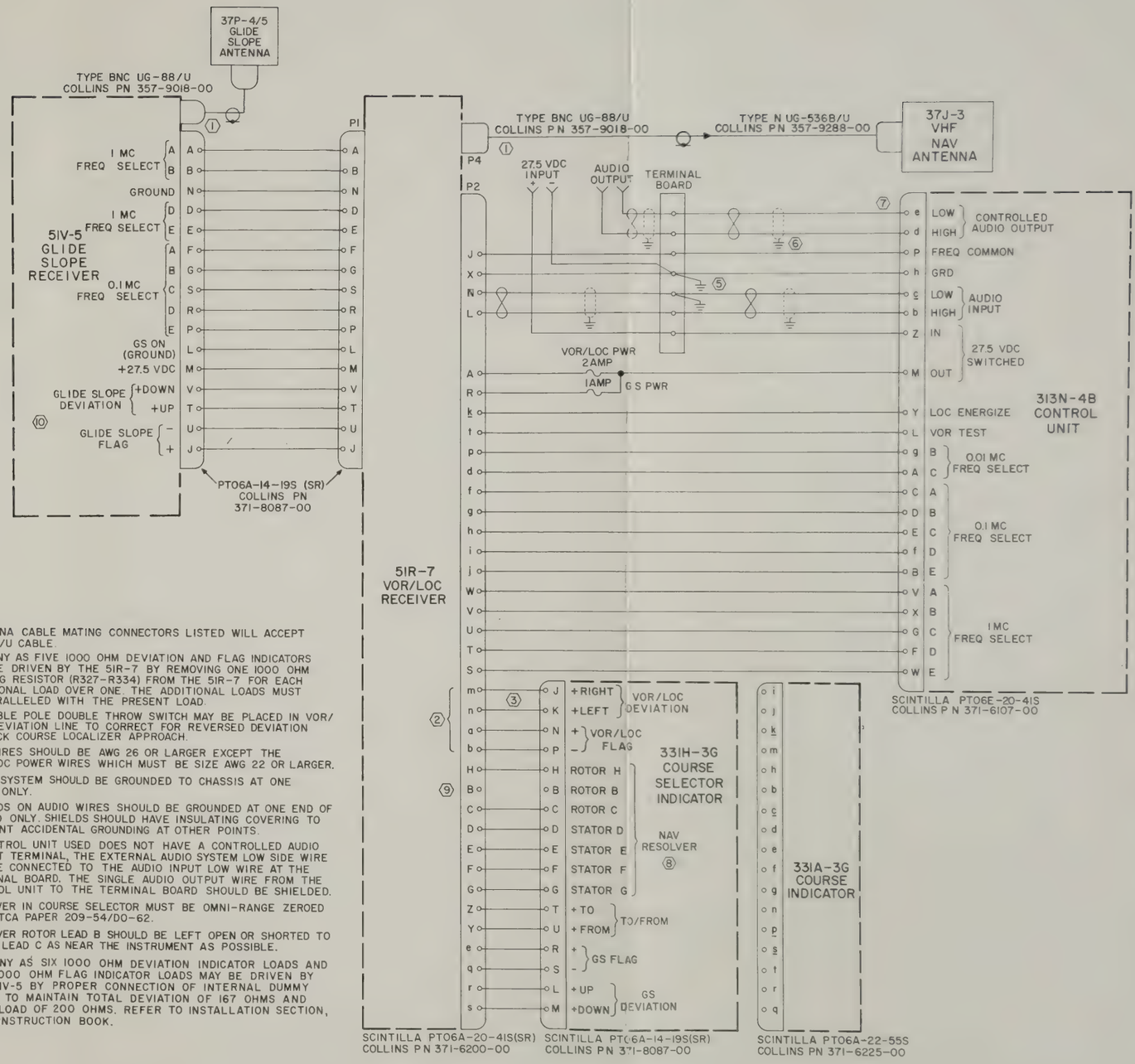


Figure 2-3. 51V-5/51R-8 VOR/ILS System



NOTES:

(1) ANTENNA CABLE MATING CONNECTORS LISTED WILL ACCEPT RG-58/U CABLE.

(2) AS MANY AS FIVE 1000 OHM DEVIATION AND FLAG INDICATORS MAY BE DRIVEN BY THE 51R-7 BY REMOVING ONE 1000 OHM LOADING RESISTOR (R327-R334) FROM THE 51R-7 FOR EACH ADDITIONAL LOAD OVER ONE. THE ADDITIONAL LOADS MUST BE PARALLELED WITH THE PRESENT LOAD.

(3) A DOUBLE POLE DOUBLE THROW SWITCH MAY BE PLACED IN VOR/LOC DEVIATION LINE TO CORRECT FOR REVERSED DEVIATION ON BACK COURSE LOCALIZER APPROACH.

(4) ALL WIRES SHOULD BE AWG 26 OR LARGER EXCEPT THE 27.5 VDC POWER WIRES WHICH MUST BE SIZE AWG 22 OR LARGER.

(5) AUDIO SYSTEM SHOULD BE GROUNDED TO CHASSIS AT ONE POINT ONLY.

(6) SHIELDS ON AUDIO WIRES SHOULD BE GROUNDED AT ONE END OF SHIELD ONLY. SHIELDS SHOULD HAVE INSULATING COVERING TO PREVENT ACCIDENTAL GROUNDING AT OTHER POINTS.

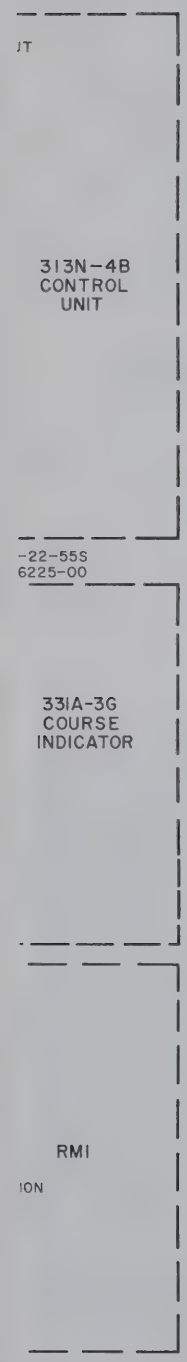
(7) IF CONTROL UNIT USED DOES NOT HAVE A CONTROLLED AUDIO OUTPUT TERMINAL, THE EXTERNAL AUDIO SYSTEM LOW SIDE WIRE MAY BE CONNECTED TO THE AUDIO INPUT LOW WIRE AT THE TERMINAL BOARD. THE SINGLE AUDIO OUTPUT WIRE FROM THE CONTROL UNIT TO THE TERMINAL BOARD SHOULD BE SHIELDED.

(8) RESOLVER IN COURSE SELECTOR MUST BE OMNI-RANGE ZEROED PER RTCA PAPER 209-54/DO-62.

(9) RESOLVER ROTOR LEAD B SHOULD BE LEFT OPEN OR SHORTED TO ROTOR LEAD C AS NEAR THE INSTRUMENT AS POSSIBLE.

(10) AS MANY AS SIX 1000 OHM DEVIATION INDICATOR LOADS AND FIVE 1000 OHM FLAG INDICATOR LOADS MAY BE DRIVEN BY THE 51V-5 BY PROPER CONNECTION OF INTERNAL DUMMY LOADS TO MAINTAIN TOTAL DEVIATION OF 167 OHMS AND FLAG LOAD OF 200 OHMS. REFER TO INSTALLATION SECTION, 51V-5 INSTRUCTION BOOK.

Figure 2-4. 51V-5/51R-7 Interconnecting Wiring Diagram


JT
313N-4B
CONTROL
UNIT
-22-55S
6225-00
331A-3G
COURSE
INDICATOR
RMI
ION

section 3

operation

3.1 General.

The functions of glide slope receiver controls and indicators are given in this section. The controls and indicators are located on associated equipments which are required for operation of the 51V-5.

3.2 Control Functions.

3.2.1 FREQUENCY SELECTOR.

The frequency selector, mounted on the control box panel, tunes the glide slope and localizer receivers simultaneously. The frequency displayed on the selector dial is the frequency of the localizer receiver. Refer to table 4-1 to determine the frequency of the glide slope receiver for the selected localizer frequency.

3.2.2 POWER SWITCH.

The power switch, mounted on the control unit, controls the application of power to the glide slope receiver and other circuits simultaneously. Typically, the VOR/LOC receiver is switched on and off with the glide slope receiver.

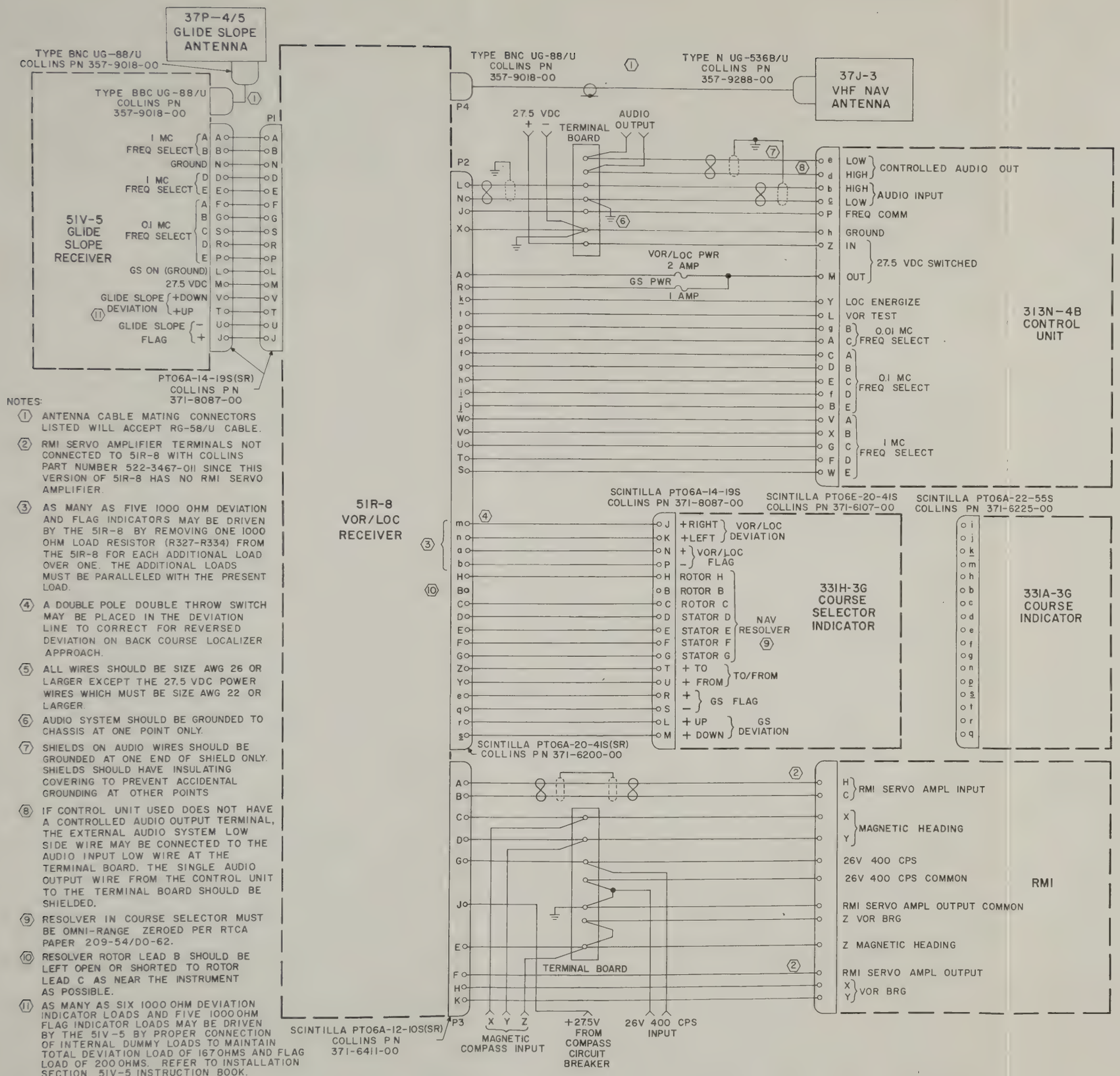
3.3 Indicator Functions.

3.3.1 DEVIATION INDICATOR.

The glide slope deviation needle indicates how much fly-up or fly-down action is necessary to put the aircraft on the glide slope. The needle is above center if the pilot should fly up and below center if the pilot should fly down.

3.3.2 WARNING FLAG.

A normal glide slope signal will cause the warning flag to be retracted. If the signal input to the receiver falls below a usable level, or if a malfunction occurs, the flag will appear.



NOTES:

1. ANTENNA CABLE MATING CONNECTORS LISTED WILL ACCEPT RG-58/U CABLE.
2. RMI SERVO AMPLIFIER TERMINALS NOT CONNECTED TO 51R-8 WITH COLLINS PART NUMBER 522-3467-011 SINCE THIS VERSION OF 51R-8 HAS NO RMI SERVO AMPLIFIER.
3. AS MANY AS FIVE 1000 OHM DEVIATION AND FLAG INDICATORS MAY BE DRIVEN BY THE 51R-8 BY REMOVING ONE 1000 OHM LOAD RESISTOR (R327-R334) FROM THE 51R-8 FOR EACH ADDITIONAL LOAD OVER ONE. THE ADDITIONAL LOADS MUST BE PARALLELED WITH THE PRESENT LOAD.
4. A DOUBLE POLE DOUBLE THROW SWITCH MAY BE PLACED IN THE DEVIATION LINE TO CORRECT FOR REVERSED DEVIATION ON BACK COURSE LOCALIZER APPROACH.
5. ALL WIRES SHOULD BE SIZE AWG 26 OR LARGER EXCEPT THE 27.5 VDC POWER WIRES WHICH MUST BE SIZE AWG 22 OR LARGER.
6. AUDIO SYSTEM SHOULD BE GROUNDED TO CHASSIS AT ONE POINT ONLY.
7. SHIELDS ON AUDIO WIRES SHOULD BE GROUNDED AT ONE END OF SHIELD ONLY. SHIELDS SHOULD HAVE INSULATING COVERING TO PREVENT ACCIDENTAL GROUNDING AT OTHER POINTS
8. IF CONTROL UNIT USED DOES NOT HAVE A CONTROLLED AUDIO OUTPUT TERMINAL, THE EXTERNAL AUDIO SYSTEM LOW SIDE WIRE MAY BE CONNECTED TO THE AUDIO INPUT LOW WIRE AT THE TERMINAL BOARD. THE SINGLE AUDIO OUTPUT WIRE FROM THE CONTROL UNIT TO THE TERMINAL BOARD SHOULD BE SHIELDED.
9. RESOLVER IN COURSE SELECTOR MUST BE OMNI-RANGE ZEROED PER RTCA PAPER 209-54/DO-62.
10. RESOLVER ROTOR LEAD B SHOULD BE LEFT OPEN OR SHORTED TO ROTOR LEAD C AS NEAR THE INSTRUMENT AS POSSIBLE.
11. AS MANY AS SIX 1000 OHM DEVIATION INDICATOR LOADS AND FIVE 1000 OHM FLAG INDICATOR LOADS MAY BE DRIVEN BY THE 51V-5 BY PROPER CONNECTION OF INTERNAL DUMMY LOADS TO MAINTAIN TOTAL DEVIATION LOAD OF 167 OHMS AND FLAG LOAD OF 200 OHMS. REFER TO INSTALLATION SECTION, 51V-5 INSTRUCTION BOOK.

Figure 2-5. 51V-5/51R-8 Interconnecting Wiring Diagram

section 3

operation

3.1 General.

The functions of glide slope receiver controls and indicators are given in this section. The controls and indicators are located on associated equipments which are required for operation of the 51V-5.

3.2 Control Functions.

3.2.1 FREQUENCY SELECTOR.

The frequency selector, mounted on the control box panel, tunes the glide slope and localizer receivers simultaneously. The frequency displayed on the selector dial is the frequency of the localizer receiver. Refer to table 4-1 to determine the frequency of the glide slope receiver for the selected localizer frequency.

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The power switch, mounted on the control unit, controls the application of power to the glide slope receiver and other circuits simultaneously. Typically, the VOR/LOC receiver is switched on and off with the glide slope receiver.

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3.3.1 DEVIATION INDICATOR.

The glide slope deviation needle indicates how much fly-up or fly-down action is necessary to put the aircraft on the glide slope. The needle is above center if the pilot should fly up and below center if the pilot should fly down.

3.3.2 WARNING FLAG.

A normal glide slope signal will cause the warning flag to be retracted. If the signal input to the receiver falls below a usable level, or if a malfunction occurs, the flag will appear.

section 4

principles of operation

4.1 General.

This section presents a functional description of glide slope generation and reception and a detailed description of the circuits used in the 51V-5 to accomplish reception. The function description is intended to aid in understanding the complete glide slope system. The 51V-5 circuit description is intended primarily as an aid to maintenance.

4.2 Principles of Glide Slope System.

The glide slope signal is radiated by a complex antenna array located adjacent to and approximately 1000 feet from the approach end of the runway. This array effectively produces two intersecting lobes, one above the other. The upper lobe is modulated predominantly with a 90-cps tone and the lower lobe with a 150-cps tone. At the intersection of these lobes, and along a straight line connecting the point of intersection and the antenna array, the percentages of modulation of the two lobes are equal. This line of equal modulation defines the glide path. If the aircraft is above the glide path, as in position A of figure 4-1, the 90-cps modulation will predominate and the glide slope deviation indicator will be displaced as shown. The glide angle is typically 2.5 degrees.

4.3 Block Diagram Theory of Operation.

The 51V-5 is a dual-conversion superheterodyne receiver. It uses wide-band injection and r-f filtering to cover the entire frequency range. The amplitude modulated frequencies of 90 and 150 cps are detected, separated, and converted to d-c voltages to operate the associated glide slope deviation and flag alarm indicators.

The r-f input from the glide slope antenna is coupled through a band-pass filter to first mixer CR1 (refer to figure 4-2). The first oscillator Q1 output frequency is coupled through tripler Q2 and injection amplifier Q3 to the first mixer. The difference frequency is selected in the mixer output and coupled through 30-mc amplifier Q4 and filter FL1 to second mixer-oscillator Q5. The 30-mc signal is mixed with the oscillator frequency of 26.9 megacycles. The difference frequency is selected and coupled through 3.1-mc filter FL2 to the 3.1-megacycle i-f amplifier.

The 3.1-mc i-f signal is transformer coupled through three stages of amplification (Q6-Q8) to detector CR20. The detector output is applied to transistor Q9 which acts as an emitter-follower for audio signals and as a d-c amplifier for the agc voltage. The agc output is coupled to second agc amplifier Q10, and the audio output is coupled to an audio amplifier consisting of Q11, Q12, and Q13. Agc voltage output of the second agc amplifier is applied to the 30-mc i-f amplifier Q4 and to the first two 3.1-mc i-f amplifiers (Q6 and Q7). The output from first audio amplifier Q11 is transformer coupled to a push-pull audio amplifier (Q12 and Q13). The audio amplifier output is filtered to separate the 90- and 150-cps components, which are applied to the output circuit. In the output circuit

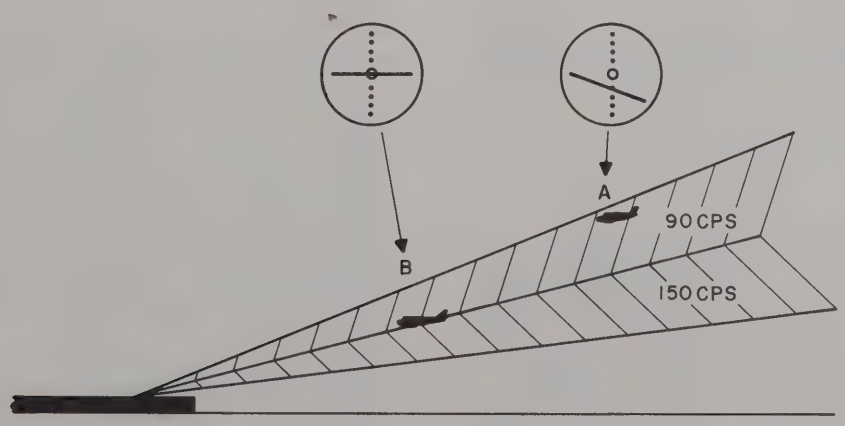


Figure 4-1. Flying the Glide Path

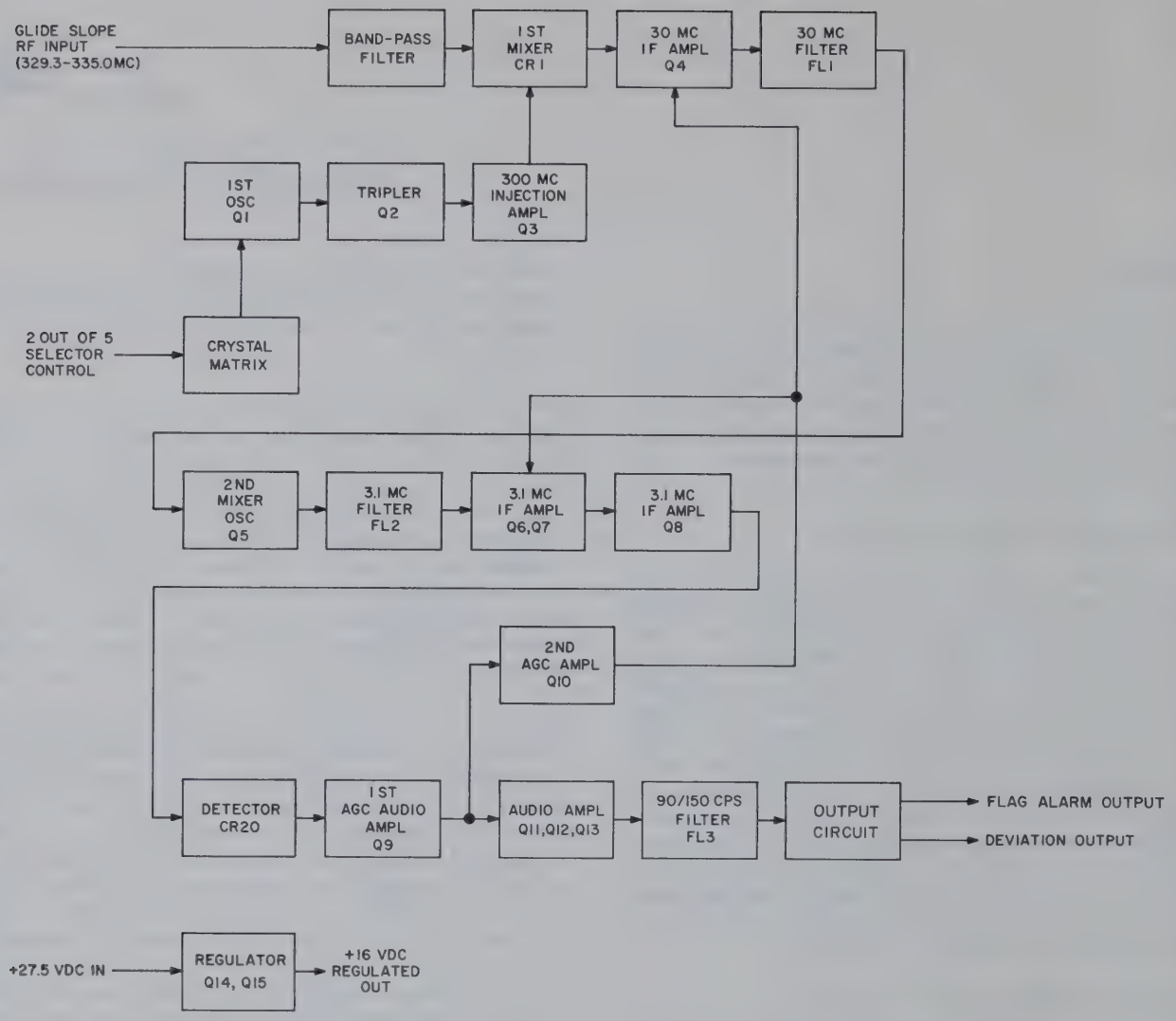


Figure 4-2. 51V-5 Glide Slope Receiver Block Diagram

the 90- and 150-cps glide slope signals are rectified and added to provide the flag alarm output and subtracted to provide the deviation output.

4.4 51V-5 Detailed Circuit Theory.

4.4.1 GENERAL.

The frequency scheme of the 51V-5 operation as a dual-conversion receiver is shown in figure 4-3. When the 51V-5 is tuned to receive a glide slope frequency of 329.3 megacycles, the first oscillator is operating at a frequency of 99.7667 megacycles. This oscillator frequency is tripled and coupled through an injection amplifier to the first mixer. This injection frequency, 299.3 megacycles, and the r-f input frequency, 329.3 megacycles, are combined in the first mixer. The difference, 30 megacycles, is selected and coupled through the first i-f amplifier to the second mixer. This 30-megacycle signal is combined with the 26.9-megacycle second injection frequency. The difference, 3.1 megacycles, is selected and coupled through the second i-f amplifier to the detector. The first oscillator and first injection frequency are listed in figure 4-3 for each r-f input frequency.

4.4.2 FIRST OSCILLATOR, TRIPLER, AND 300-MC INJECTION AMPLIFIER.

4.4.2.1 FIRST OSCILLATOR CRYSTAL SELECTION. Two 1-mc and two 0.1-mc control wires will be grounded when a localizer frequency is selected at the navigation control unit. A simplified schematic of the matrix used to select the crystal which is connected in the first oscillator circuit is shown

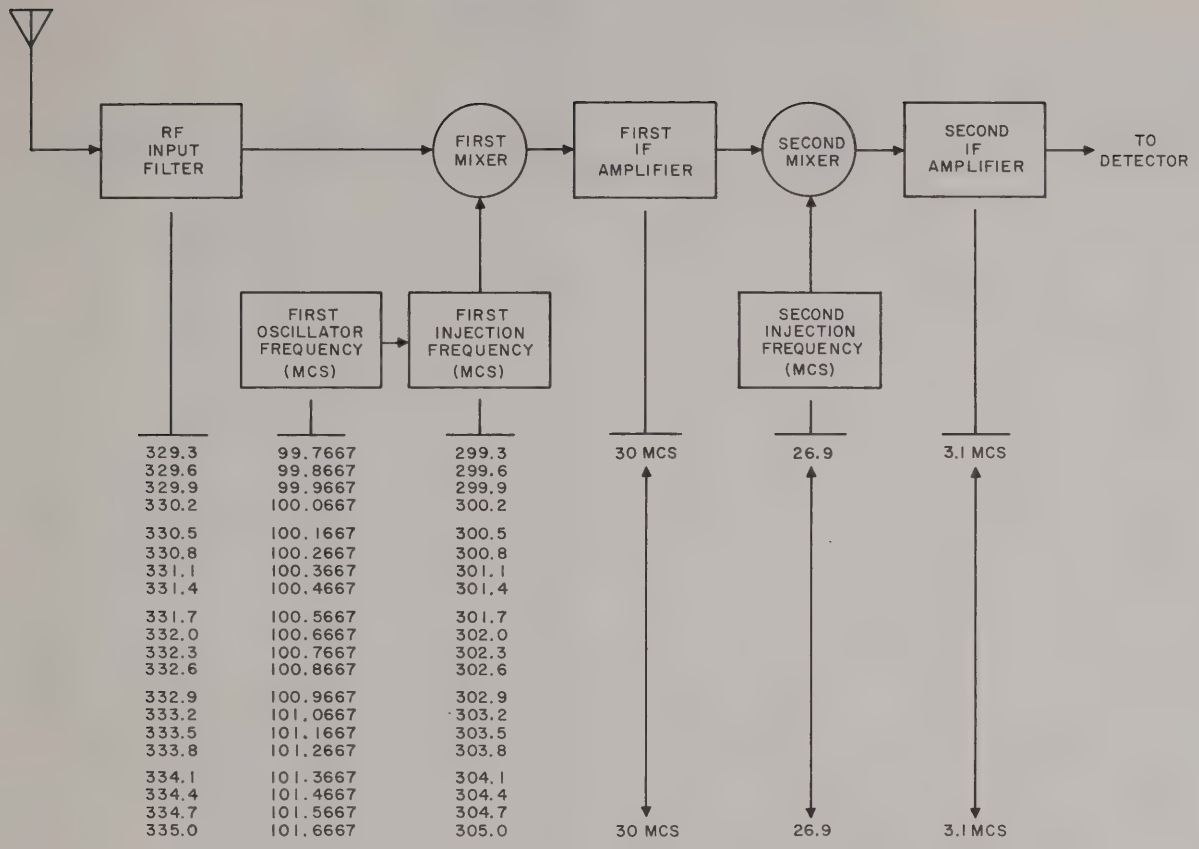


Figure 4-3. 51V-5 Glide Slope Receiver, Frequency Scheme

in figure 4-4. The localizer frequency and the paired glide slope frequency are listed in table 4-1 along with the combination of control wires that are grounded. The diode switches that are turned on and the selected crystal are also listed in table 4-1.

A crystal is connected in the first oscillator circuit when one of the 0.1-mc diode switches (CR6 through CR10) and one of the 1-mc diode switches (CR2 through CR5) are turned on. A 0.1-mc switch is turned on when two 0.1-mc control wires are grounded. If the 0.1-mc A and B control wires are grounded, diode CR6 is forward biased since the anode of CR6 is connected to +16 volts through R12 and the cathode of CR6 is connected to ground through R36 and CR18 in parallel with R37 and CR19. The remaining 0.1-mc diode switches (CR7 through CR10) are reverse biased when CR6 is forward biased. The voltage at the anodes of CR7 through CR10 is approximately 4 volts due to the current through R12 and CR6. The voltage at the cathodes of CR7 through CR10 is more positive than 4 volts since the cathodes are connected to +16 volts through the matrix resistors (R24 through R38). The 1-mc switching operates the same as the 0.1-mc switching.

4.4.2.2 OSCILLATOR AND INJECTION CIRCUITRY. The first oscillator uses a 2N2362 in a common emitter configuration. Refer to figure 4-4. Energy from the collector of Q1 is fed back to the base circuit through the crystal selected by the diode matrix. The output from Q1 is tapped from L5 and coupled to tripler Q2 through capacitor C26. Inductors L8 and L9 compensate for crystal and diode switch capacitance.

Transistor Q2 is operated beyond its linear region as a tripler. Refer to figure 7-4. Capacitor C29 in the collector circuit of Q2 is adjusted to resonate with L6 at 300 mc, so the third harmonic of the first oscillator frequency is developed across L6. This signal is coupled through capacitor C30 to the 300-mc injection amplifier. Transistor Q3 is used in a common base configuration to amplify the signal obtained from the frequency tripler. The output of Q3 is tuned to 300 megacycles by C32. The output from the amplifier is coupled through capacitor C33 to the first mixer, CR1.

4.4.3 R-F INPUT BAND-PASS FILTER AND FIRST MIXER. (Refer to figure 7-4.)

The r-f input signal is coupled from J6 of the 51V-5 to the tap on inductor L1 of the first section of a four-section band-pass filter. This filter circuit is tuned to 332 megacycles by means of brass slugs.

TABLE 4-1. CRYSTAL MATRIX COMPONENTS

SELECTED LOCALIZER FREQUENCY (mc)	CONTROL WIRES GROUNDED		PAIRED GLIDE SLOPE FREQUENCY (mc)	DIODES BIASED ON	CRYSTAL SELECTED
	0.1 mc	1 mc			
108.1	AB	AD	334.7	CR6, CR2	Y11
108.3	BC	AD	334.1	CR7, CR2	Y12
108.5	CD	AD	329.9	CR8, CR2	Y13
108.7	DE	AD	330.5	CR9, CR2	Y14
108.9	AE	AD	329.3	CR10, CR2	Y15
109.1	AB	AE	331.4	CR6, CR3	Y6
109.3	BC	AE	332.0	CR7, CR3	Y7
109.5	CD	AE	332.6	CR8, CR3	Y8
109.7	DE	AE	333.2	CR9, CR3	Y9
109.9	AE	AE	333.8	CR10, CR3	Y10
110.1	AB	BE	334.4	CR6, CR4	Y1
110.3	BC	BE	335.0	CR7, CR4	Y2
110.5	CD	BE	329.6	CR8, CR4	Y3
110.7	DE	BE	330.2	CR9, CR4	Y4
110.9	AE	BE	330.8	CR10, CR4	Y5
111.1	AB	AB	331.7	CR6, CR5	Y16
111.3	BC	AB	332.3	CR7, CR5	Y17
111.5	CD	AB	332.9	CR8, CR5	Y18
111.7	DE	AB	333.5	CR9, CR5	Y19
111.9	AE	AB	331.1	CR10, CR5	Y20

The glide slope r-f signal is coupled to the first mixer from tap on inductor L4 of the fourth section of the filter. The glide slope r-f signal is mixed with the 300-mc injection amplifier output in diode CR1. Inductor L25 is antiresonant at 30 megacycles, so the difference frequency developed by CR1 is coupled to the 30-megacycle i-f amplifier, Q4.

4.4.4 30-MEGACYCLE I-F AMPLIFIER, SECOND MIXER-OSCILLATOR. (Refer to figure 7-4.)

The 30-megacycle i-f amplifier consists of transistor Q2 and associated circuitry. The difference frequency developed across inductor L25 is coupled through C35 to the base of Q4. The i-f signal is amplified and coupled from the collector of Q4 to 30-megacycle filter FL1. The output of FL1 is applied to the base of transistor Q5. This transistor operates as a mixer and as an oscillator. The frequency of the oscillator is 29.9 megacycles (frequency of crystal Y21). The 30-megacycle output of FL1 and the 26.9-mc output of the oscillator are mixed, and the difference frequency is coupled through 3.1-megacycle filter FL2 to the input circuit of first 3.1-megacycle i-f amplifier Q6.

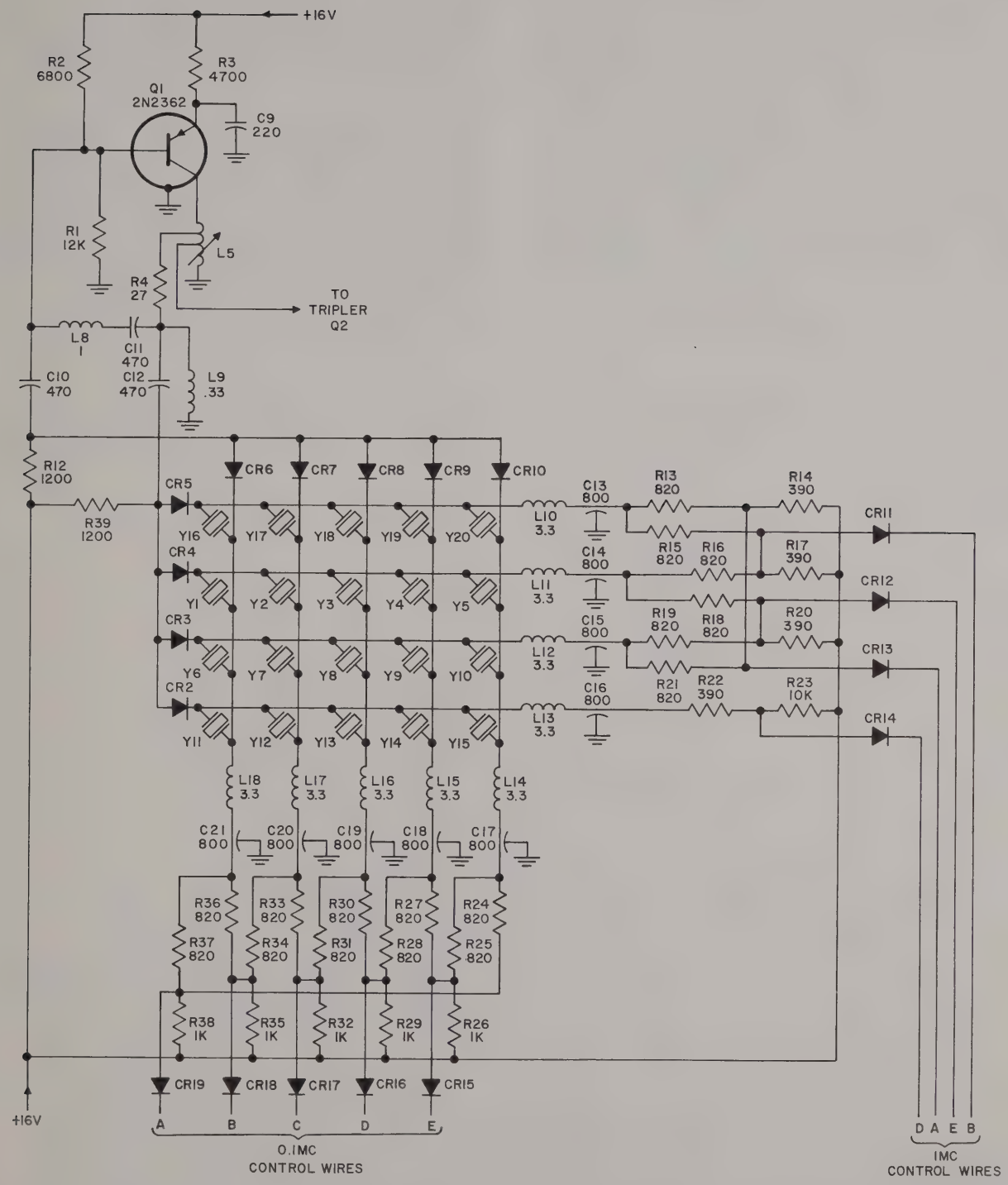


Figure 4-4. First Oscillator, Simplified Schematic Diagram

4.4.5 3.1-MEGACYCLE I-F AMPLIFIER. (Refer to figure 7-4.)

The 3.1-megacycle i-f signal from FL2 is coupled to the base of first 3.1-megacycle amplifier Q6. Three amplifiers, Q6, Q7, and Q8, are conventional common emitter amplifiers with single-tuned transformers in the collector circuits. Capacitor C54 is used for neutralization to provide properly phased feedback to increase the stability of Q8. The secondary of the last i-f transformer, T3, is used only as a neutralization source. Coupling from the collector of Q8 to the detector is capacitive through C58. An i-f gain control, R61, is connected across the secondary of transformer T1. This control is adjusted for maximum r-f sensitivity and signal-to-noise ratio.

4.4.6 AGC/AUDIO DETECTOR AND AGC AMPLIFIERS. (Refer to figure 4-5.)

The output from the third 3.1-mc i-f amplifier is rectified by diode CR20. Detected audio and a d-c component (which is used for agc) proportional to carrier strength appear at the base of transistor Q9. Transistor Q9 functions as an emitter-follower for audio signals and as a common-emitter amplifier for the d-c component. The audio output from this stage is tapped off deflection sensitivity control R74. This control is adjusted to obtain 78 microamperes of deviation current for a standard glide slope deviation signal input. The audio signal from the tap of R74 is coupled through C63 to the base of second audio amplifier Q11.

The d-c component at the collector of Q9 is applied to, and amplified by, second agc amplifier Q10. Agc voltage, which is proportional to the carrier level, is filtered by C60 and C62 to remove any remaining audio or i-f component, and applied to the 30-megacycle i-f and first two 3.1-megacycle i-f amplifiers. Thermal resistor RT2 provides temperature compensation in the agc amplifier.

4.4.7 AUDIO AMPLIFIERS AND OUTPUT CIRCUITS.

The detected audio applied to the base of Q11 is amplified and transformer coupled to a push-pull second audio amplifier stage containing transistors Q12 and Q13. The output of the audio amplifier is

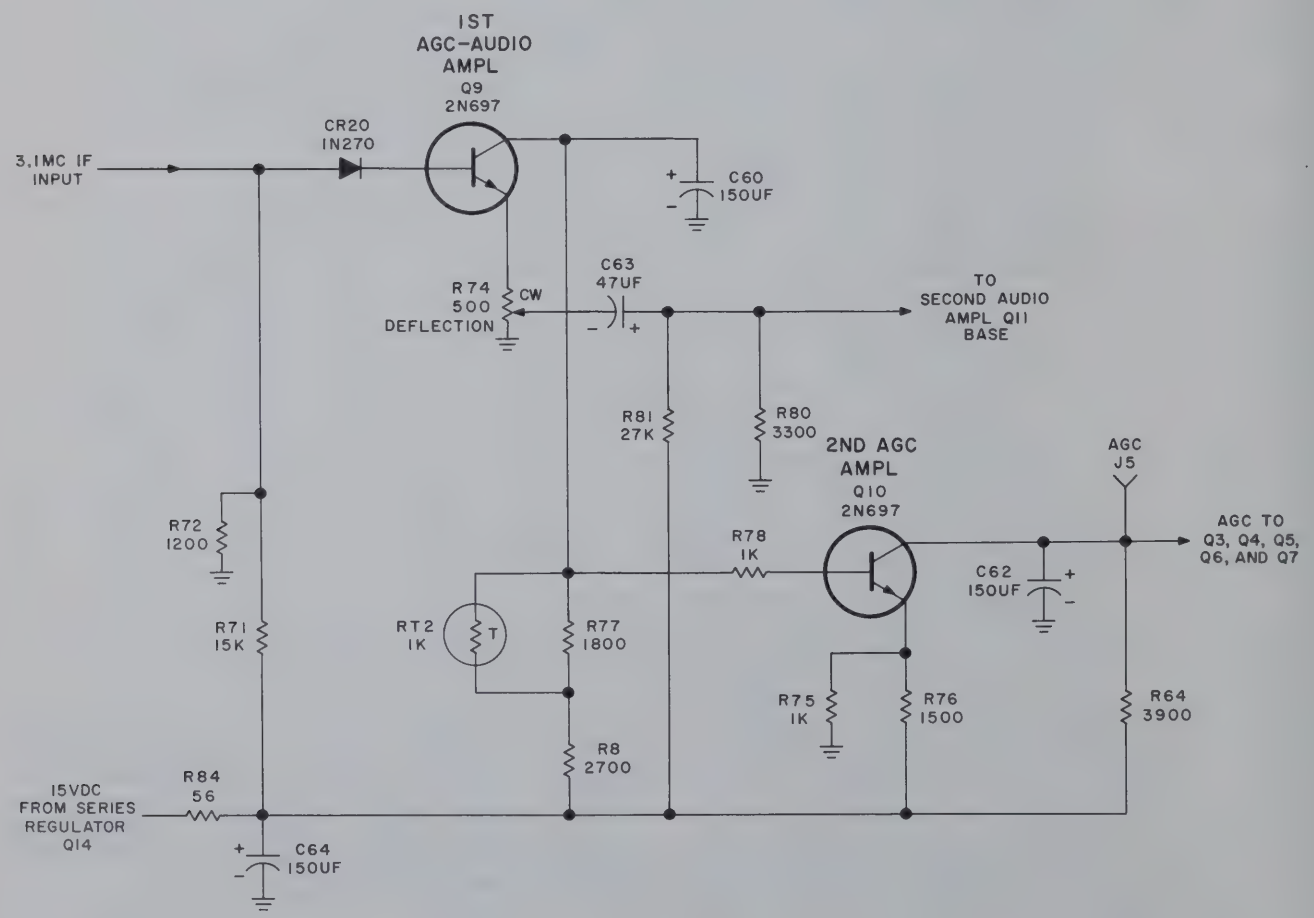


Figure 4-5. AGC Circuits, Simplified Schematic Diagram

coupled to the output circuits through filter FL3. The filter has two tuned secondaries, one resonant at 150 cps and the other resonant at 90 cps. Each audio signal is rectified by a full-wave rectifier as shown in figure 4-6. The current resulting from the voltage developed across the 150-cps secondary winding is rectified by CR21 and CR22 and flows through the deviation indicator in the direction shown by the solid arrows. This current tends to deflect the needle up and produce a positive voltage at J7-T. Current resulting from the voltage developed across the 90-cps secondary winding is rectified by CR23 and CR24 and tends to deflect the deviation needle down and produce a positive voltage at J7-V. If the 150- and 90-cps signals are equal zero current will flow causing the deviation needle to center. Balance control R95 is adjusted to provide 0-microampere deviation with a standard glide slope centering signal input. The sum of the voltages developed across R93 and R94 will cause current to flow through the flag alarm of the course indicator to mask the glide slope flag. Flag control R97 is adjusted to provide 350 microamperes through the flag alarm with a standard glide slope centering signal input. When the glide slope signal is lost because of airborne or ground equipment failure, the flag alarm will be visible to indicate that further use of the facility is unreliable. Thermal resistor RT1 provides temperature compensation in the flag alarm circuit. Flag dummy loads (R103, R104, and R105) are connected or disconnected to provide a flag load of 200 ohms with up to five external flag alarm loads. Deviation dummy loads (R79, R96, and R102) are connected or disconnected to provide a deviation load of 167 ohms with up to 6 external deviation loads.

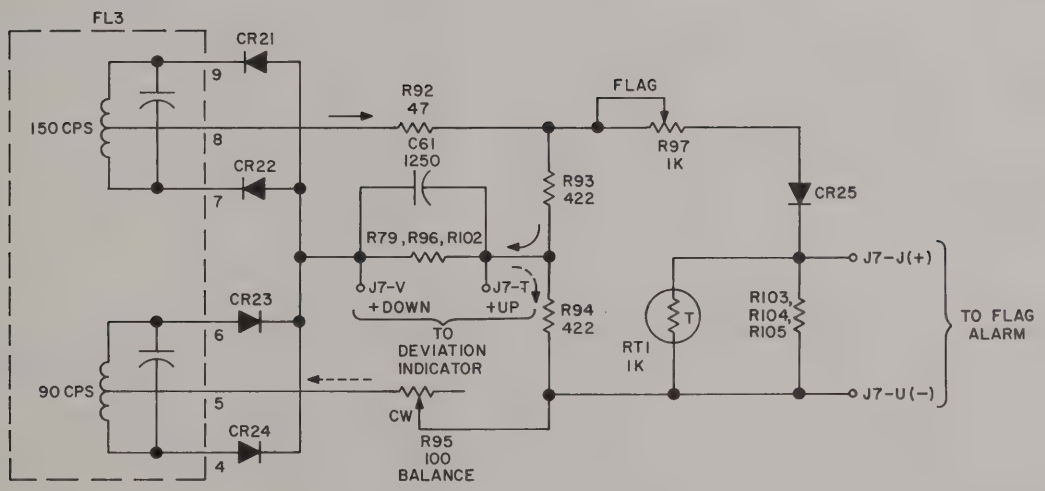


Figure 4-6. Output Circuits, Simplified Schematic Diagram

section 5

maintenance

5.1 General.

This section presents an operator's performance check and alignment, testing, and trouble-shooting procedures.

5.2 Operational Check.

To check for proper operation of the glide slope system perform the ramp test outlined in paragraph 2-6.

5.3 Periodic Maintenance.

The 51V-5 has no moving parts and therefore requires no periodic maintenance.

5.4 Alignment and Testing Procedure.

5.4.1 GENERAL.

The alignment and testing procedures should be performed after repairs are made to ensure correct operation of the 51V-5. If any of the test results are not within specifications, but nearly so, the alignment procedures will normally correct the performance. If the results are far from being correct after alignment, check the test setup; then refer to the trouble-shooting section. The following definitions will apply throughout this section.

a. Standard Glide Slope Test Signal: The standard glide slope test signal shall be an r-f carrier, amplitude modulated simultaneously with 90 cps ±0.3 percent and 150 cps ±0.3 percent signals so that the sum of their separate modulation percentages equals 80 ±2 percent.

b. Standard Glide Slope Centering Signal: The standard glide slope centering signal shall be a standard glide slope test signal in which the difference in depth of modulation between the 90 and 150 cps signals is less than 0.2 percent (0-db audio ratio).

c. Standard Glide Slope Deviation Signal: The standard glide slope deviation signal shall be a standard glide slope test signal in which the difference in depth of modulation between the 90- and 150-cps signals is a ratio of 2.0 db. Standard deflection shall be 78 microamperes with a 700 uv r-f input signal.

d. R-F Signal Level: All references to r-f signal level refer to the voltage at the input to a 6-db, 50-ohm pad connected between the signal generator and the receiver.

5.4.2 PRELIMINARY PROCEDURES.

The equipment required to align and test the 51V-5 is listed in table 5-1. Equivalent equipment may be substituted for the equipment listed. A test fixture schematic with pin designations for component interconnection is given in figure 7-1. Connect the 51V-5 and test equipment in the setup shown in figure 5-1.

TABLE 5-1. TEST EQUIPMENT REQUIRED

ITEM	IDENTIFICATION
D-c vtvm	Hewlett-Packard 410B.
Glide slope test set	Boonton 232-A.
D-c power supply	20 to 32 volts d-c at 0.5 ampere, Kepco SC-32-5.
6-db attenuator	Boonton type 505A (supplied with 232-A).
Deviation indicator meter	Weston 901 (150-0-150 ua, 1000 ohms, 1% accuracy).
Flag alarm indicator meter	Weston 901 (0.5 ma, modified to 1000 ohms, 1% accuracy).
Frequency counter	Hewlett-Packard 524.
R-f generator	Hewlett-Packard 608D.
Oscillator tuning probe	See figure 7-3.

NOTE

The deviation and flag alarm outputs must be properly loaded to correctly align and test the 51V-5. The flag and deviation meters called out in table 5-1 and shown in figure 5-1 present signal 1000-ohm loads to the flag and deviation circuits. Refer to paragraph 2-5 and check that the proper dummy loads are connected.

Apply power to the test equipment and to the 51V-5. If the d-c input current on the test fixture milliammeter indicates more than 260 ma, immediately remove power from the 51V-5 and refer to paragraph 5.5.

5.4.3 ALIGNMENT PROCEDURES.

5.4.3.1 I-F AND SECOND OSCILLATOR ALIGNMENT.

a. Connect the d-c vtvm to the agc jack J5.
b. Measure and record the agc voltage at J5 with no signal output from the 232-A.
c. Tune the 51V-5 to 332.0 mc by selecting 109.3 mc on the control unit, if used, or positioning S1 on the test fixture to 332.0.
d. Adjust the 232-A FREQUENCY control to 332.0 mc.
e. Adjust the 232-A OUTPUT LEVEL control so the agc voltage is approximately 0.5 volt d-c above that recorded in step b.
f. Tune L26, T1, T2, and T3 (see figure 7-2) for maximum agc voltage. Reduce output signal level from the 232-A as required to keep the agc voltage at approximately 0.5 volt d-c above the zero signal level recorded in step b.

5.4.3.2 R-F AND FIRST OSCILLATOR ALIGNMENT.

a. Remove the first oscillator shield cover. Connect the d-c vtvm with the oscillator tuning probe to the Y7 crystal terminals and adjust the vtvm to its lowest d-c range.
b. Tune L5 (see figure 7-2) for minimum indication on the d-c vtvm. The voltage should decrease to a value less than 0.2 volt d-c.
c. Remove the oscillator tuning probe and replace the oscillator shield cover.
d. Adjust the 232-A signal generator output to 332.0 mc and tune the 51V-5 to receive on 332.0 mc by selecting 109.3 mc on the control unit, if used, or setting S1 on the test fixture to 332.0
e. Connect the d-c vtvm at agc jack J5. Adjust the OUTPUT LEVEL control so that the agc voltage is approximately 0.5 volt d-c above the zero signal value.
f. Tune C29 and C32 (see figure 7-2) for maximum indication on the flag meter.
g. Trim the leads of two 1000-ohm resistors to a length of 1/2 inch.
h. Connect one of these resistors between J2 and ground, and the other between J4 and ground.
i. Tune L1 and L3 (see figure 7-2) for maximum agc voltage indication on the d-c vtvm (at J5).
j. Remove the resistors from J2 and J4. Connect one of these resistors between J1 and ground, and the other between J3 and ground.
k. Tune L2 and L4 (see figure 7-2) for maximum agc voltage indication on the d-c vtvm (at J5).

5.4.3.3 I-F GAIN ADJUSTMENT.

a. Set the OUTPUT LEVEL control at 5 uv. Adjust the CARRIER ADJUST control for a red-line indication on the 232-A CARRIER MONITOR meter.
b. Turn i-f gain control R61 (see figure 7-2) counterclockwise to end stop.
c. Slowly rotate R61 (see figure 7-2) in a clockwise direction while observing the flag meter. A point will be reached where further rotation causes no appreciable increase in flag current. Lock potentiometer R61 at this point, being careful not to change setting of R61.

5.4.3.4 INSTRUMENTATION ADJUSTMENTS.

a. Apply a 700-uv standard centering signal at 332.0 mc to the 51V-5.
b. Adjust balance control R95 (see figure 7-2) for an indication of 0 ua on the deviation meter.
c. Apply a 700-uv standard deviation signal and adjust deflection sensitivity control R74 (see figure 7-2) for 78 ua on the deviation meter.
d. Apply a 700-uv standard centering signal and adjust flag control R97 (see figure 7-2) for an indication of 350 ua on the flag meter.
e. Repeat steps a through d until the tolerances listed in table 5-2 are met. Tighten locking nuts on all controls.

TABLE 5-2
TOLERANCES FOR INSTRUMENTATION ADJUSTMENTS

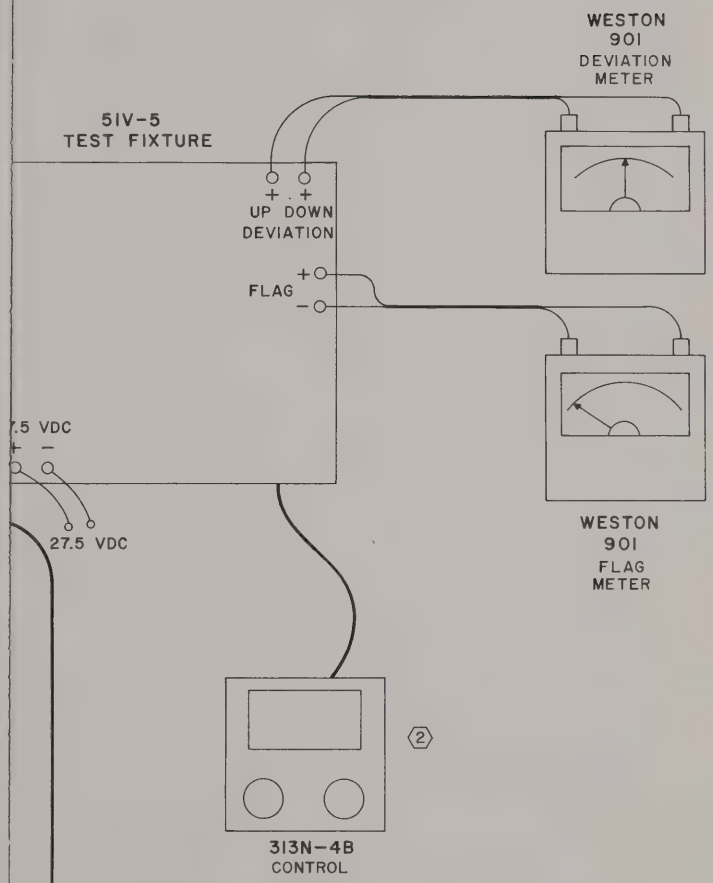
STEP	TOLERANCES
b	0 ±0.5 ua
c	78 ±4 ua
d	350 ±10 ua

5.4.4 TESTING PROCEDURES.

5.4.4.1 TEST SETUP. Connect the equipment as shown in figure 5-1 with the HP-608D instead of the 232-A.

5.4.4.2 I-F SELECTIVITY.

a. Adjust the HP-608D to obtain a 700-uv signal at 332.0 mc and tune the 51V-5 to 332.0 mc by selecting 109.3 mc on the control unit, if used, or setting S1 on the test fixture to 332.0.



NOTES:

1. FREQUENCY COUNTER IS LOOSELY COUPLED TO IF STRIP WITH A FEW TURNS OF WIRE.
2. CONTROL IS REQUIRED IF SWITCHES S1A, S1B, S1C, AND S1D NOT BUILT INTO TEST FIXTURE.
3. FOR DETAILS OF CABLE CONNECTING 51V-5 TO TEST FIXTURE SEE SCHEMATIC OF TEST FIXTURE.
4. HP608D IS USED IN PLACE OF 232-A TO MEASURE RECEIVER BANDWIDTH.

Figure 5-1. Test Setup

NOTE

The deviation and flag alarm outputs must be properly loaded to correctly align and test the 51V-5. The flag and deviation meters called out in table 5-1 and shown in figure 5-1 present signal 1000-ohm loads to the flag and deviation circuits. Refer to paragraph 2-5 and check that the proper dummy loads are connected.

Apply power to the test equipment and to the 51V-5. If the d-c input current on the test fixture milliammeter indicates more than 260 ma, immediately remove power from the 51V-5 and refer to paragraph 5.5.

5.4.3 ALIGNMENT PROCEDURES.

5.4.3.1 I-F AND SECOND OSCILLATOR ALIGNMENT.

a. Connect the d-c vtvm to the agc jack J5.
b. Measure and record the agc voltage at J5 with no signal output from the 232-A.
c. Tune the 51V-5 to 332.0 mc by selecting 109.3 mc on the control unit, if used, or positioning S1 on the test fixture to 332.0.
d. Adjust the 232-A FREQUENCY control to 332.0 mc.
e. Adjust the 232-A OUTPUT LEVEL control so the agc voltage is approximately 0.5 volt d-c above that recorded in step b.
f. Tune L26, T1, T2, and T3 (see figure 7-2) for maximum agc voltage. Reduce output signal level from the 232-A as required to keep the agc voltage at approximately 0.5 volt d-c above the zero signal level recorded in step b.

5.4.3.2 R-F AND FIRST OSCILLATOR ALIGNMENT.

a. Remove the first oscillator shield cover. Connect the d-c vtvm with the oscillator tuning probe to the Y7 crystal terminals and adjust the vtvm to its lowest d-c range.
b. Tune L5 (see figure 7-2) for minimum indication on the d-c vtvm. The voltage should decrease to a value less than 0.2 volt d-c.
c. Remove the oscillator tuning probe and replace the oscillator shield cover.
d. Adjust the 232-A signal generator output to 332.0 mc and tune the 51V-5 to receive on 332.0 mc by selecting 109.3 mc on the control unit, if used, or setting S1 on the test fixture to 332.0
e. Connect the d-c vtvm at agc jack J5. Adjust the OUTPUT LEVEL control so that the agc voltage is approximately 0.5 volt d-c above the zero signal value.
f. Tune C29 and C32 (see figure 7-2) for maximum indication on the flag meter.
g. Trim the leads of two 1000-ohm resistors to a length of 1/2 inch.
h. Connect one of these resistors between J2 and ground, and the other between J4 and ground.
i. Tune L1 and L3 (see figure 7-2) for maximum agc voltage indication on the d-c vtvm (at J5).
j. Remove the resistors from J2 and J4. Connect one of these resistors between J1 and ground, and the other between J3 and ground.
k. Tune L2 and L4 (see figure 7-2) for maximum agc voltage indication on the d-c vtvm (at J5).

5.4.3.3 I-F GAIN ADJUSTMENT.

a. Set the OUTPUT LEVEL control at 5 uv. Adjust the CARRIER ADJUST control for a red-line indication on the 232-A CARRIER MONITOR meter.
b. Turn i-f gain control R61 (see figure 7-2) counterclockwise to end stop.
c. Slowly rotate R61 (see figure 7-2) in a clockwise direction while observing the flag meter. A point will be reached where further rotation causes no appreciable increase in flag current. Lock potentiometer R61 at this point, being careful not to change setting of R61.

5.4.3.4 INSTRUMENTATION ADJUSTMENTS.

a. Apply a 700-uv standard centering signal at 332.0 mc to the 51V-5.
b. Adjust balance control R95 (see figure 7-2) for an indication of 0 ua on the deviation meter.
c. Apply a 700-uv standard deviation signal and adjust deflection sensitivity control R74 (see figure 7-2) for 78 ua on the deviation meter.
d. Apply a 700-uv standard centering signal and adjust flag control R97 (see figure 7-2) for an indication of 350 ua on the flag meter.
e. Repeat steps a through d until the tolerances listed in table 5-2 are met. Tighten locking nuts on all controls.

TABLE 5-2
TOLERANCES FOR INSTRUMENTATION ADJUSTMENTS

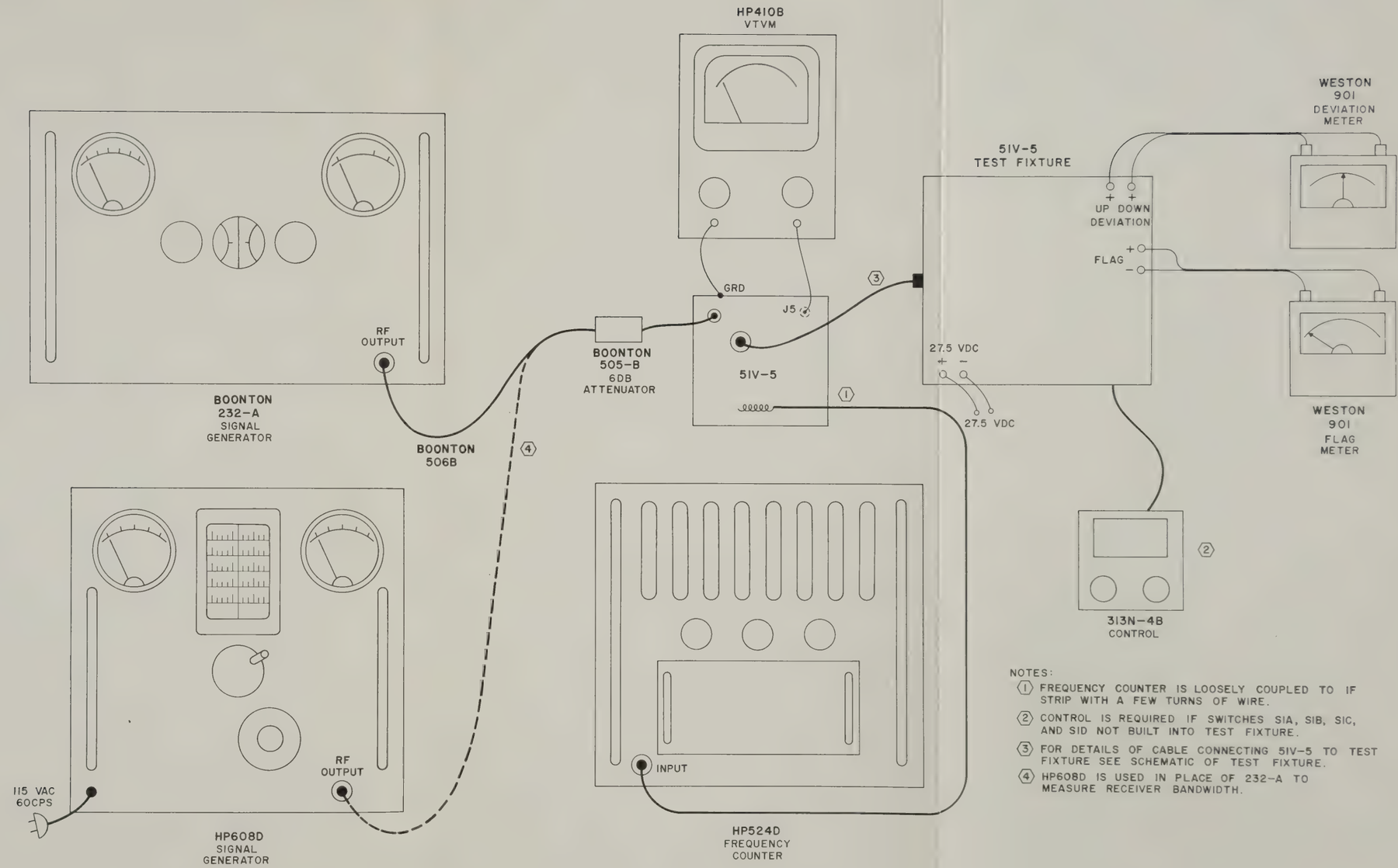
STEP	TOLERANCES
b	0 ±0.5 ua
c	78 ±4 ua
d	350 ±10 ua

5.4.4 TESTING PROCEDURES.

5.4.4.1 TEST SETUP. Connect the equipment as shown in figure 5-1 with the HP-608D instead of the 232-A.

5.4.4.2 I-F SELECTIVITY.

a. Adjust the HP-608D to obtain a 700-uv signal at 332.0 mc and tune the 51V-5 to 332.0 mc by selecting 109.3 mc on the control unit, if used, or setting S1 on the test fixture to 332.0.



NOTES:

1. FREQUENCY COUNTER IS LOOSELY COUPLED TO IF STRIP WITH A FEW TURNS OF WIRE.
2. CONTROL IS REQUIRED IF SWITCHES SIA, SIB, SIC, AND SID NOT BUILT INTO TEST FIXTURE.
3. FOR DETAILS OF CABLE CONNECTING 5IV-5 TO TEST FIXTURE SEE SCHEMATIC OF TEST FIXTURE.
4. HP608D IS USED IN PLACE OF 232-A TO MEASURE RECEIVER BANDWIDTH.

Figure 5-1. Test Setup

b. Connect the d-c vtvm to agc test jack J6. Observe the d-c vtvm and adjust the HP-608D FREQUENCY control for maximum agc voltage. Measure the frequency of the 3.1-mc i-f signal with the frequency counter.

c. Measure the agc voltage at J6 with zero output from the HP-608D.

d. Adjust the amplitude of the injection signal from the HP-608D so the agc voltage measured at J5 is 0.5 volt d-c above the zero signal value measured in step c. Read and record the generator output level in db as indicated on the HP-608D attenuator dial.

e. Increase the HP-608D output 6 db by adjusting the HP-608D attenuator dial to a value which is 6 db less than the value recorded in step d.

f. Lower the HP-608D frequency until the agc voltage measured at J5 is 0.5 volt above that measured in step c.

g. Measure the frequency of the 3.1-mc i-f signal with the frequency counter and record.

h. Increase the frequency of the HP-608D until the agc voltage rises to maximum and then falls off to 0.5 volt d-c above that recorded in step c.

i. Measure the frequency of the 3.1-mc i-f signal with the frequency counter and record.

j. Determine the 6-db bandwidth of the 51V-5 i-f by finding the difference in kilocycles between the frequency recorded in step g and the frequency recorded in step i.

k. Determine the resonant frequency error of the 51V-5 i-f by finding the difference in kc between the nominal center frequency, 3.1 mc, and the resonant frequency. The resonant frequency is defined as the frequency midway between the 6-db attenuation points. To determine resonant frequency in this case, divide the bandwidth calculated in step j by 2 and add the result to the frequency recorded in step g. Record the resonant frequency error.

l. Adjust the HP-608D attenuator dial to a value 60 db less than the value recorded in step c.

m. Repeat steps e through j to determine the bandwidth and resonant frequency error using the 60-db attenuation points.

n. Compare the selectivity data obtained with the following minimum performance standards to determine whether or not the 51V-5 i-f is in proper alignment. Minimum performance standards follow:

(1) The bandwidth at 6 db (step j) should be not less than 140 kc.

(2) The 6-db resonant frequency error (step k) should not exceed 10 kc.

(3) The bandwidth at 60-db points (step m) should not exceed 450 kc.

(4) The 60-db resonant frequency error (step m) should not exceed 45 kc.

5.4.4.3 LINEARITY AND BALANCE.

a. Replace the HP-608D with the 232-A and apply a standard glide slope test signal of 700 uv at 332.0 mc to the 51V-5.

b. Measure the deviation current on the deviation meter with a modulation ratio of 3.3 db > 90 150. The deviation current should be 116 to 142 ua.

c. Record the deviation current with a modulation ratio of 2 db 90 >150. The deviation current should be 77.5 to 78.5 ua.

d. Measure the deviation current with a modulation ratio of 0 db. The deviation current should be -0.5 to +0.5 ua.

e. Measure the deviation current with a modulation ratio of 2 db 150/90. The deviation current should be 75 to 81 ua.

f. Measure the deviation current with a modulation ratio of 3.3 db 150/90. The deviation current should be 116 to 142 ua.

5.4.4.4 AGC CHARACTERISTICS.

a. Apply a glide slope standard centering signal at 332.0 mc to the 51V-5.

b. Measure the deviation current with an r-f signal level of 700 uv. The deviation current should be 0 ±0.5 ua.

c. Measure the deviation current while the r-f input level is varied from 100 uv to 30,000 uv. The deviation current should be between +4 and -4 ua over the entire range.

d. Apply a standard deviation signal, 90 > 150, at a level of 700 uv.

e. Vary the r-f level from 700 to 14,000 uv. The deviation current should be not less than 74 ua or more than 82 ua over the entire range.

5.4.4.5 FLAG CHARACTERISTICS.

a. Apply a standard glide slope test signal at 332.0 mc.

b. Measure the flag current with a 700-uv r-f signal modulated 40 percent at 90 cps and 40 percent at 150 cps. The flag current should be 340 to 360 ua.

c. Measure the flag current with zero r-f input. The flag current should be not more than 10 ua.

d. Measure the flag current with a 700-uv r-f signal modulated 40 percent at 90 cps. The flag current should be not more than 200 ua.

e. Measure the flag current with a 700-uv r-f signal modulated 40 percent at 150 cps. The flag current should be not more than 200 ua.

5.4.4.6 R-F SENSITIVITY.

a. Apply a standard glide slope deviation signal to the 51V-5.

b. Determine the minimum r-f input signal required to produce a deviation current of 47 ua. The r-f level should be not more than 20 uv.

c. Repeat step b for all 20 channels.

5.5 Trouble Shooting.

Trouble shooting should be a logical progression of location of malfunctioning section, then location of stage, and finally location of the defective component. The procedures given are arranged in that manner with a sectional trouble-shooting chart to locate the faulty section and a-c and d-c voltage readings to further isolate the cause of malfunction.

TABLE 5-3. TROUBLE-SHOOTING CHART

STEP	INSTRUCTIONS	NORMAL INDICATION	INDICATION OBTAINED	PROCEDURE
PRELIMINARY	Connect 51V-5 in test setup shown in figure 5-1. Set control to 109.30 mc. Set the 232-A MOD switch to 90-150~, the TONE RATIO control to 0, FREQUENCY control to 332.0 mc, and the OUTPUT LEVEL to 700 uv.			
1	Set the test fixture POWER switch to ON.	Power source current should be 200 to 260 ma.	a. Current greater than 260 ma.	a. Immediately set the test fixture POWER switch to OFF. Make continuity checks in the d-c regulator circuit and in the receiver B plus circuitry. Possible trouble: shorted B+ line.
			b. Current less than 120 ma.	b. Check if voltage on Q14 emitter is 16 ±1.6 volts d-c. If voltage is low, check d-c regulator circuitry. Possible trouble: faulty CR27, CR28, or open resistor.
			c. Normal current.	c. Proceed to step 2.
2	Continue with instructions set up in step 1.	Test fixture flag indicator is 350 ±10 ua, and deviation indicator meter reading is 0 ±0.5 ua.	a. Low reading on flag indicator and deviation indicator shows a right or left deflection.	a. Proceed to step 3.
			b. Zero current on flag indicator and deviation indicator reading is normal.	b. Make continuity checks in the flag indicator circuit. Possible trouble: open R97 or CR25.
			c. Flag indicator reading is low or zero and deviation indicator reading remains at zero.	c. Proceed to step 4.

TABLE 5-3. TROUBLE-SHOOTING CHART (Cont)

STEP	INSTRUCTIONS	NORMAL INDICATION	INDICATION OBTAINED	PROCEDURE
3	Vary the OUTPUT LEVEL of the 232-A from 100 to 30,000 uv.	Flag and deviation indicator readings should remain nearly constant.	a. Flag and deviation indicator readings remain constant.	a. Make continuity checks in the output circuit. Check d-c resistance of diodes CR21-CR24 in both directions.
			b. Flag and deviation indicator readings vary as the signal input is varied.	b. Check a-c and d-c voltages in agc amplifiers. Possible trouble: faulty C60, C62, or C64.
4	Connect a d-c vtvm between J2 and ground and vary the 232-A OUTPUT LEVEL control to obtain an output level of 0 to 30 uv from 232-A.	Agc voltage, indicated on d-c vtvm, should have a minimum change of 1.0 volt d-c.	a. Change in agc voltage is a minimum of 1.0 volt d-c.	a. Make a-c and d-c voltage checks in audio amplifiers Q11, Q12, and Q13 to isolate the trouble in these stages.
			b. Agc voltage is constant.	b. Make a-c and d-c voltage checks in i-f, r-f, first oscillator, and band-pass filter sections of 51V-5.

section 6

parts list

ITEM	DESCRIPTION	COLLINS PART NUMBER
	51V-5 GLIDE SLOPE RADIO RECEIVER	522-3743-00
C1	CAPACITOR, FIXED, CERAMIC: 5 uuf ±1 uuf, 5000 v d-c, Centralab Division of Globe-Union, Inc. part no. DA855-013	913-0104-00
C2	CAPACITOR, FIXED, CERAMIC: 0.27 uuf ±5%, 500 v d-c; Stackpole Carbon Co. part no. GA-27UUFPORM5PCT	913-2970-00
C3	CAPACITOR, FIXED, CERAMIC: same as C1	913-0104-00
C4	CAPACITOR, FIXED, CERAMIC: same as C2	913-2970-00
C5	CAPACITOR, FIXED, CERAMIC: same as C1	913-0104-00
C6	CAPACITOR, FIXED, CERAMIC: same as C2	913-2970-00
C7	CAPACITOR, FIXED, CERAMIC: same as C1	913-0104-00
C8	NOT USED	
C9	CAPACITOR, FIXED, MICA: 220 uuf ±5%, 500 v d-c; MIL type CM05F221J03	912-2840-00
C10	CAPACITOR, FIXED, CERAMIC: 470 uuf ±20%, 500 v d-c; MIL type CK60AX471M	913-1189-00
C11	CAPACITOR, FIXED, CERAMIC: same as C10	913-1189-00
C12	CAPACITOR, FIXED, CERAMIC: same as C10	913-1189-00
C13	CAPACITOR, FIXED, CERAMIC: 800 uf, 300 v d-c; GMV tolerance; Erie Resistor Corp. part no. SK801460X5T0801P	913-4454-00
C14 thru C22	CAPACITOR, FIXED, CERAMIC: same as C13	913-4454-00
C23	CAPACITOR, FIXED, CERAMIC: same as C10	913-1189-00
C24	CAPACITOR, FIXED, CERAMIC: same as C10	913-1189-00
C25	CAPACITOR, FIXED, CERAMIC: same as C10	913-1189-00
C26	CAPACITOR, FIXED, CERAMIC: same as C10	913-1189-00
C27	CAPACITOR, FIXED, MICA: 15 uuf ±5%, 500 v d-c; Electro-Motive Mfg. Co. part no. DM15C150J01	912-2759-00
C28	CAPACITOR, FIXED, CERAMIC: 7.5 uuf ±5%, 500 v d-c; Stackpole Carbon Co. part no. GA-7.5 UUFPORM5PCT	913-2997-00
C29	CAPACITOR, VARIABLE, GLASS: 0.5 uuf to 4.5 uuf, 1000 v d-c; JFD Electronics Corp. part no. VC21G	922-0415-00
C30	CAPACITOR, FIXED, MICA: 5 uuf ±5%, 500 v d-c Electro Motvie Mfg. Co. part no. DM15C050J01	912-2750-00
C31	CAPACITOR, FIXED, MICA: same as C27	912-2759-00
C32	CAPACITOR, VARIABLE, GLASS: same as C29	922-0415-00
C33	CAPACITOR, FIXED, MICA: same as C30	912-2750-00
C34	CAPACITOR, FIXED, CERAMIC: same as C13	913-4454-00
C35	CAPACITOR, FIXED, MICA: 470 uuf ±5%, 300 v d-c; Electro Motive Mfg. Co. part no. DM15F471J03	912-2864-00
C36	CAPACITOR, FIXED, CERAMIC: same as C13	913-4454-00
C37	CAPACITOR, FIXED, CERAMIC: 0.01 uf +80 -20%, 100 v d-c; Erie Resistor Corp. part no. 855502 X5G0 103P	913-3680-00
C38	CAPACITOR, FIXED, CERAMIC: same as C13	913-4454-00
C39	CAPACITOR, FIXED, CERAMIC: 0.02 uf -20%, +80%, 100 v d-c; Erie Resistor Corp. part no. 815501 X5G0 203P	913-3678-00
C40	CAPACITOR, FIXED, CERAMIC: same as C39	913-3678-00
C41	CAPACITOR, FIXED, MICA: 47 uuf ±5%, 500 v d-c; MIL type CM05E470J03	912-2792-00
C42	CAPACITOR, FIXED, MICA: 36 uuf ±5%, 500 v d-c; MIL type CM05E360J03	912-2783-00
C43	CAPACITOR, FIXED, CERAMIC: 4700 uuf ±20%, 500 v d-c; MIL type CK62AW472M	913-1187-00
C44	CAPACITOR, FIXED, CERAMIC: 6.2 uuf ±5%, v d-c; Stackpole Carbon Co. part no. GA-6.2 UUFPORM5PCT	913-2995-00
C45	CAPACITOR, FIXED, ELECTROLYTIC: 0.47 uf, ±10%, 35 v d-c; Kemet Co. part no. KR47J35KS	184-7708-00
C46	NOT USED	
C47	CAPACITOR, FIXED, CERAMIC: same as C39	913-3678-00
C48	CAPACITOR, FIXED, CERAMIC: same as C39	913-3678-00
C49	CAPACITOR, FIXED, CERAMIC: same as C39	913-3678-00
C50	CAPACITOR, FIXED, CERAMIC: same as C39	913-3678-00
C51	CAPACITOR, FIXED, CERAMIC: same as C39	913-3678-00
C52	CAPACITOR, FIXED, ELECTROLYTIC: same as C45	184-7708-00
C53	NOT USED	
C54	CAPACITOR, FIXED, CERAMIC: 10 uuf, ±5%, 500 v d-c; Stackpole Carbon Co. part no. GA-10. 0UUFPORM5PCT	913-3000-00
C55	CAPACITOR, FIXED, CERAMIC: same as C39	913-3678-00
C56	CAPACITOR, FIXED, CERAMIC: same as C39	913-3678-00
C57	CAPACITOR, FIXED, ELECTROLYTIC: same as C45	184-7708-00
C58	CAPACITOR, FIXED, MICA: 68 uuf ±5%, 500 v d-c, MIL type CM05E680J03	912-2804-00
C59	CAPACITOR, FIXED, CERAMIC: same as C39	913-3678-00
C60	CAPACITOR, FIXED, ELECTROLYTIC: 150 uf ±20%, 15 v d-c; Kemet Co. part no. K150J15S	184-7656-00
C61	CAPACITOR, FIXED, ELECTROLYTIC: 1250 uf, 1600 uf max, 5 v d-c; Sprague Electric Co. part no. P35694	183-1276-00
C62	CAPACITOR, FIXED, ELECTROLYTIC: same as C60	184-7656-00
C63	CAPACITOR, FIXED, ELECTROLYTIC: 47.0 uf ±20%, 6 v d-c; Erie Resistor Corp. part no. 901-506 BOBO 476M	184-7401-00
C64	CAPACITOR, FIXED, ELECTROLYTIC: same as C60	184-7656-00
C65	CAPACITOR, FIXED, ELECTROLYTIC: 25 uf -15% to +75%, 100 v d-c; MIL type CL25BN250UF3	184-8027-00
C66	CAPACITOR, FIXED, CERAMIC: 3 uuf ±5%, 500 v d-c; Stackpole Carbon Co. part no. GA-3.0 UUFPORM5PCT	913-2998-00
CR1	SEMICONDUCTOR DEVICE, DIODE: silicon; 0-110 in. dia by 0.300 in. lg JEDEC type 1N82A	353-2542-00
CR2	SEMICONDUCTOR DEVICE, DIODE: germanium, hermetically sealed, 0.107 in dia by 0.270 lg; JEDEC type 1N270	353-2018-00
CR3 thru CR10	SEMICONDUCTOR DEVICE, DIODE: same as CR2	353-2018-00
CR11	SEMICONDUCTOR DEVICE, DIODE: silicon, hermetically sealed 0.125 in. dia by 0.300 in. lg; JEDEC type 1N647	353-2596-00
CR12 thru CR19	SEMICONDUCTOR DEVICE, DIODE: same as CR11	353-2596-00
CR20	SEMICONDUCTOR DEVICE, DIODE: same as CR2	353-2018-00
CR21	SEMICONDUCTOR DEVICE, DIODE: same as CR2	353-2018-00
CR22	SEMICONDUCTOR DEVICE, DIODE: same as CR2	353-2018-00
CR23	SEMICONDUCTOR DEVICE, DIODE: same as CR2	353-2018-00
CR24	SEMICONDUCTOR DEVICE, DIODE: same as CR2	353-2018-00
CR25	SEMICONDUCTOR DEVICE, DIODE: silicon; 0.105 in. dia by 0.300 in. lg, JEDEC type 1N457	353-0204-00
CR26	SEMICONDUCTOR DEVICE, DIODE: silicon, hermetically sealed 0.240 in. dia by 0.405 in. lg; JEDEC type 1N3255	353-3276-00
CR27	SEMICONDUCTOR DEVICE, DIODE: silicon, hermetically sealed; 0.125 in. dia by 0.300 in. lg; JEDEC type 1N755A	353-2718-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
CR28	SEMICONDUCTOR DEVICE, DIODE: same as CR27	353-2718-00
CR29	SEMICONDUCTOR DEVICE, DIODE: same as CR11	353-2596-00
FL1	FILTER, BANDPASS: 0.875 in. by 0.937 in. by 1.821 in.; Communications Coil Co. part no. 406-1	241-0374-00
FL2	FILTER, BANDPASS: 0.940 in. by 1.125 in. by 2.250 in.; Communications Coil Co. part no. X-332-2	241-0375-00
FL3	FILTER, BANDPASS: 1 in. by 2.031 in. by 2.031 in. Tulex, Inc. part no. 60E193	673-0823-00
H1	NUT BLANK: Delrin, 0.062 in. thick by 0.312 in. hex	553-2411-002
H2	POST, ELECTRICAL, MECHANICAL: alumimum, chemical film finish; 4-40 UNC-2B thd	540-9045-003
H3	POST, ELECTRICAL, MECHANICAL: alumimum, chemical film finish; 4-40 UNC-2B thd	540-9046-003
H4	SCREW, CAPTIVE: cres, passivated finish, 0.375 in. lg	506-6072-002
H5	WASHER: cres; 0.140 in. ID, 0.3125 in. OD, 0.010 in. thk	545-7533-003
H6	SCREW, STUD, PRESSED: cres, passivate finish; 0.187 in. dia by 1.875 in.lg	756-3972-002
H7	BOLT ASSEMBLY, CLAMP: aluminum, chemical film finish	756-4657-00
J1	JACK, TIP: 3000 VRMS, 5.5 amp continuous duty Sealectro Corp. part no. SKT-41 WHITE	360-0266-00
J2	JACK, TIP: same as J1	360-0266-00
J3	JACK, TIP: same as J1	360-0266-00
J4	JACK, TIP: same as J1	360-0266-00
J5	JACK, TIP: same as J1	360-0266-00
J6	CONNECTOR, RECEPTACLE, ELECTRICAL: 500 v d-c, 50 ohms nom, 5 amp; Joint Electronic Type Designation System part no. UG-1094/U	357-9183-00
L1	COIL, RADIO FREQUENCY: #16 AWG	548-3960-002
L2	COIL, RADIO FREQUENCY: same as L1	548-3960-002
L3	COIL, RADIO FREQUENCY: same as L1	548-3960-002
L4	COIL, RADIO FREQUENCY: same as L1	548-3960-002
L5	COIL, OSCILLATOR: #28 AWG, coil form	549-6300-003
L6	COIL, RADIO FREQUENCY: #18 AWG	548-3959-002
L7	COIL, RADIO FREQUENCY: same as L6	548-3959-002
L8	COIL, RADIO FREQUENCY: single layer wound, 1.00 uh; 15PCT 0.30 ohm, resistance, 850 ma current rating; Jeffers Electric Co. part no. 4411	240-0062-00
L9	COIL, RADIO FREQUENCY: single layer wound; 0.33 nom inductance, ±20PCT 0.07 ohm resistance, 1700 ma current; Jeffers Electronics Division of Speer Carbon Co. part no. 4411-3	240-0068-00
L10	COIL, RADIO FREQUENCY: single layer wound; 3.30 uh nom inductance ±10PCT, 0.15 ohms d-c resistance 1150 ma current rating; Jeffers Electronics Division of Speer Carbon Co. part no. 4421-1	240-0065-00
L11 thru L19	COIL, RADIO FREQUENCY: same as L10	240-0065-00
L20	COIL, RADIO FREQUENCY: single layer wound; 0.47 uh nom inductance, ±20PCT 0.09 ohm d-c resistance, 1600 ma current rating; Jeffers Electronics Div. of Speer Carbon Co. part no. 4411-4	240-0060-00
L21	COIL, RADIO FREQUENCY: same as L20	240-0060-00
L22	COIL, RADIO FREQUENCY: same as L20	240-0060-00
L23	COIL, RADIO FREQUENCY: same as L20	240-0060-00
L24	COIL, RADIO FREQUENCY: same as L20	240-0060-00
L25	COIL, RADIO FREQUENCY: 15.0 uh ±10%, 32 mc res frequency, 1.20 ohms max d-c resistance, 400 ma d-c rated curret; Jeffers Electronics part no. 4421-9	240-0151-00
L26	COIL, OSCILLATOR: 0.205 in. dia by 0.936 in. lg	548-3958-002
MP1	CLIP, RETAINING: cres; passivate finish, 0.030 in. thickness	502-60005-002
MP2	BUSHING, HANDLE: cres, passivate finish 0.187 in. lg by 0.246 in. dia less flange, ID 0.156 in. A end, 0.203 in. B end	756-3967-002
MP3	HANDLE: cres, black vinyl finish	756-4445-004
P1	CONNECTOR, PLUG, ELECTRICAL: 19 #20 female contacts, 500 v a-c, 700 v d-c 7.5 amp, Burndy Corp. part no. BT06AC14-19S	371-8087-00
P2	CONNECTOR, RECEPTACLE, ELECTRICAL: 19 male contacts, 500 v rms, 700 v d-c, 7.5 amp	371-6971-00
Q1	TRANSISTOR: germanium; hermetically sealed; JEDEC type 2N2362	352-0407-00
Q2	TRANSISTOR: germanium, PNP hermetically sealed; JEDEC type 2N2398	352-0406-00
Q3	TRANSISTOR: same as Q2	352-0406-00
Q4	TRANSISTOR: same as Q2	352-0406-00
Q5	TRANSISTOR: germanium, PNP, hermetically sealed; JEDEC type 2N741A	352-0342-00
Q6	TRANSISTOR: germanium, PNP, hermetically sealed; JEDEC type 2N1285	352-0243-00
Q7	TRANSISTOR: same as Q6	352-0243-00
Q8	TRANSISTOR: same as Q6	352-0243-00
Q9	TRANSISTOR: silicon, NPN, hermetically sealed; JEDEC type 2N697	352-0197-00
Q10	TRANSISTOR: same as Q9	352-0197-00
Q11	TRANSISTOR: same as Q9	352-0197-00
Q12	TRANSISTOR: same as Q9	352-0197-00
Q13	TRANSISTOR: same as Q9	352-0197-00
Q14	TRANSISTOR: silicon, NPN, hermetically sealed; JEDEC type 2N1484	352-0536-00
Q15	TRANSISTOR: same as Q9	352-0197-00
R1	RESISTOR, FIXED, COMPOSITION: 12,000 ±10%, 1/4 w; MIL type RC07GF123K	745-0788-00
R2	RESISTOR, FIXED, COMPOSITION: 6800 ohms ±10%, 1/4 w; MIL type RC07GF682K	745-0779-00
R3	RESISTOR, FIXED, COMPOSITION: 4700 ohms ±10%, 1/4 w; MIL type RC07GF472K	745-0773-00
R4	RESISTOR, FIXED, COMPOSITION: 27 ohms ±10% 1/4 w; MIL type RC07GF270K	745-0692-00
R5	RESISTOR, FIXED, COMPOSITION: same as R3	745-0773-00
R6	RESISTOR, FIXED, COMPOSITION: same as R2	745-0779-00
R7	RESISTOR, FIXED, COMPOSITION: same as R1	745-0788-00
R8	RESISTOR, FIXED, COMPOSITION: 2700 ohms ±10%, 1/4 w; MIL type RC07GF272K	745-0764-00
R9	RESISTOR, FIXED, COMPOSITION: same as R3	745-0773-00
R10	RESISTOR, FIXED, COMPOSITION: same as R2	745-0779-00
R11	RESISTOR, FIXED, COMPOSITION: same as R1	745-0788-00
R12	RESISTOR, FIXED, COMPOSITION: 1200 ohms ±5%, 1/4 w; MIL type RC07GF122J	745-0751-00
R13	RESISTOR, FIXED, COMPOSITION: 820 ohms ±5%, 1/4 w; MIL type RC07GF821J	745-0745-00
R14	RESISTOR, FIXED, COMPOSITION: 390 ohms ±10%, 1 w; MIL type RC32GF391K	745-3335-00
R15	RESISTOR, FIXED, COMPOSITION: same as R13	745-0745-00
R16	RESISTOR, FIXED, COMPOSITION: same as R13	745-0745-00
R17	RESISTOR, FIXED, COMPOSITION: same as R14	745-3335-00
R18	RESISTOR, FIXED, COMPOSITION: same as R13	745-0745-00
R19	RESISTOR, FIXED, COMPOSITION: same as R13	745-0745-00
R20	RESISTOR, FIXED, COMPOSITION: same as R14	745-3335-00
R21	RESISTOR, FIXED, COMPOSITION: same as R13	745-0745-00
R22	RESISTOR, FIXED, COMPOSITION: 390 ohms ±10%, 1/4 w; MIL type RC07GF391K	745-0734-00
R23	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±10%, 1/4 w; MIL type RC07GF103K	745-0785-00
R24	RESISTOR, FIXED, COMPOSITION: same as R13	745-0745-00
R25	RESISTOR, FIXED, COMPOSITION: same as R13	745-0745-00
R26	RESISTOR, FIXED, COMPOSITION: 1000 ohms ±10%, 1/2 w; MIL type RC20GF102K	745-1352-00
R27	RESISTOR, FIXED, COMPOSITION: same as R13	745-0745-00
R28	RESISTOR, FIXED, COMPOSITION: same as R13	745-0745-00
R29	RESISTOR, FIXED, COMPOSITION: same as R26	745-1352-00
R30	RESISTOR, FIXED, COMPOSITION: same as R13	745-0745-00
R31	RESISTOR, FIXED, COMPOSITION: same as R13	745-0745-00
R32	RESISTOR, FIXED, COMPOSITION: same as R26	745-1352-00
R33	RESISTOR, FIXED, COMPOSITION: same as R13	745-0745-00
R34	RESISTOR, FIXED, COMPOSITION: same as R13	745-0745-00
R35	RESISTOR, FIXED, COMPOSITION: same as R26	745-1352-00
R36	RESISTOR, FIXED, COMPOSITION: same as R13	745-0745-00
R37	RESISTOR, FIXED, COMPOSITION: same as R13	745-0745-00
R38	RESISTOR, FIXED, COMPOSITION: same as R26	745-1352-00
R39	RESISTOR, FIXED, COMPOSITION: same as R12	745-0751-00
R40	RESISTOR, FIXED, COMPOSITION: 560 ohms ±10%, 1/4 w; MIL type RC07GF561K	745-0740-00
R41	RESISTOR, FIXED, COMPOSITION: same as R2	745-0779-00
R42	RESISTOR, FIXED, COMPOSITION: same as R8	745-0764-00
R43	RESISTOR, FIXED, COMPOSITION: 47 ohms ±10%, 1/4 w; MIL type RC07GF470K	745-0701-00
R44	RESISTOR, FIXED, COMPOSITION: same as R23	745-0785-00
R45	RESISTOR, FIXED, COMPOSITION: same as R43	745-0701-00
R46	RESISTOR, FIXED, COMPOSITION: 2200 ohms ±10%, 1/4 w; MIL type RC07GF222K	745-0761-00
R47	RESISTOR, FIXED, COMPOSITION: 1000 ohms ±10%, 1/4 w; MIL type RC07GF102K	745-0749-00
R48	RESISTOR, FIXED, COMPOSITION: same as R8	745-0764-00
R49	RESISTOR, FIXED, COMPOSITION: 1800 ohms ±10%, 1/4 w; MIL type RC07GF182K	745-0758-00
R50	RESISTOR, FIXED, COMPOSITION: same as R47	745-0749-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
R51	RESISTOR, FIXED, COMPOSITION: same as R43	745-0701-00
R52	RESISTOR, FIXED, COMPOSITION: 330 ohms ±10%, 1/4 w; MIL type RC07GF331K	745-0731-00
R53	RESISTOR, FIXED, COMPOSITION: 100 ohms ±10%, 1/4 w; MIL type RC07GF101K	745-0713-00
R54	RESISTOR, FIXED, COMPOSITION: same as R8	745-0764-00
R55	RESISTOR, FIXED, COMPOSITION: 8200 ohms ±10%, 1/4 w; MIL type RC07GF822K	745-0782-00
R56	RESISTOR, FIXED, COMPOSITION: same as R43	745-0701-00
R57	RESISTOR, FIXED, COMPOSITION: same as R43	745-0701-00
R58	RESISTOR, FIXED, COMPOSITION: same as R53	745-0713-00
R59	RESISTOR, FIXED, COMPOSITION: same as R53	745-0713-00
R60	NOT USED	
R61	RESISTOR, VARIABLE: composition, 250 ohms ±20%, 1/2 w; CTS Corp. part no. BJ24248	380-1667-00
R62	RESISTOR, FIXED, COMPOSITION: same as R8	745-0764-00
R63	RESISTOR, FIXED, COMPOSITION: same as R55	745-0782-00
R64	RESISTOR, FIXED, COMPOSITION: 3900 ohms ±10%, 1/4 w; MIL type RC07GF392K	745-0770-00
R65	RESISTOR, FIXED, COMPOSITION: same as R52	745-0731-00
R66	RESISTOR, FIXED, COMPOSITION: same as R55	745-0782-00
R67	RESISTOR, FIXED, COMPOSITION: same as R3	745-0773-00
R68	RESISTOR, FIXED, COMPOSITION: 22 ohms ±10%, 1/4 w; MIL type RC07GF220K	745-0689-00
R69	RESISTOR, FIXED, COMPOSITION: same as R49	745-0758-00
R70	RESISTOR, FIXED, COMPOSITION: same as R68	745-0689-00
R71	RESISTOR, FIXED, COMPOSITION: 15,000 ohms ±10%, 1/4 w; MIL type RC07GF153K	745-0791-00
R72	RESISTOR, FIXED, COMPOSITION: 1200 ohms ±10%, 1/4 w; MIL type RC07GF122K	745-0752-00
R73	NOT USED	
R74	RESISTOR, VARIABLE, COMPOSITION: 500 ohms, ±20%, 1/2 w; CTS Corp. part no. BJ24247	380-1666-00
R75	RESISTOR, FIXED, COMPOSITION: same as R47	745-0749-00
R76	RESISTOR, FIXED, COMPOSITION: 1500 ohms ±10%, 1/4 w; MIL type RC07GF152K	745-0755-00
R77	RESISTOR, FIXED, COMPOSITION: same as R49	745-0758-00
R78	RESISTOR, FIXED, COMPOSITION: 3300 ohms ±10%, 1/4 w; MIL type RC07GF332K	745-0767-00
R79	RESISTOR, FIXED, COMPOSITION: same as R47	745-0749-00
R80	RESISTOR, FIXED, COMPOSITION: same as R78	745-0767-00
R81	RESISTOR, FIXED, COMPOSITION: 27,000 ohms ±10%, 1/4 w; MIL type RC07GF273K	745-0800-00
R82	RESISTOR, FIXED, COMPOSITION: 680 ohms ±10%, 1/4 w; MIL type RC07GF681K	745-0743-00
R83	RESISTOR, FIXED, COMPOSITION: same as R3	745-0773-00
R84	RESISTOR, FIXED, COMPOSITION: 56 ohms ±10%, 1/4 w; MIL type RC07GF560K	745-0704-00
R85	RESISTOR, FIXED, COMPOSITION: 220 ohms ±10%, 1/4 w; MIL type RC07GF221K	745-0725-00
R86	RESISTOR, FIXED, COMPOSITION: same as R23	745-0785-00
R87	RESISTOR, FIXED, COMPOSITION: same as R43	745-0701-00
R88	RESISTOR, FIXED, COMPOSITION: same as R43	745-0701-00
R89	RESISTOR, FIXED, COMPOSITION: 15 ohms ±10%, 1/4 w; MIL type RC07GF150K	745-0683-00
R90	RESISTOR, FIXED, COMPOSITION: same as R23	745-0785-00
R91	RESISTOR, FIXED, COMPOSITION: same as R64	745-0770-00
R92	RESISTOR, FIXED, COMPOSITION: same as R43	745-0701-00
R93	RESISTOR, FIXED, FILM: 422 ohms ±1%, 1/8 w; MIL type RN60B4220F	705-6578-00
R94	RESISTOR, FIXED, FILM: same as R93	705-6578-00
R95	RESISTOR, VARIABLE, COMPOSITION: 100 ohms ±20%, 1/2 w; CTS Corp. part no. BJ24243	380-1662-00
R96	RESISTOR, FIXED, COMPOSITION: same as R47	745-0749-00
R97	RESISTOR, VARIABLE: composition; 1000 ohms, ±20%, 1/2 w; CTS Corp. part no. BJ24240	380-1659-00
R98	RESISTOR, FIXED, WIREWOUND: 4.7 ohms ±5%, 3 w; MIL type RW69V4R7	747-5368-00
R99	RESISTOR, FIXED, COMPOSITION: same as R47	745-0749-00
R100	RESISTOR, FIXED, COMPOSITION: same as R12	745-0751-00
R101	RESISTOR, FIXED, COMPOSITION: same as R12	745-0751-00
R102	RESISTOR, FIXED, COMPOSITION: same as R52	745-0731-00
R103	RESISTOR, FIXED, COMPOSITION: same as R47	745-0749-00
R104	RESISTOR, FIXED, COMPOSITION: same as R47	745-0749-00
R105	RESISTOR, FIXED, COMPOSITION: same as R52	745-0731-00
RT1	RESISTOR, THERMAL: 1000 ohms ±10PCT at 25°C Bconstant 1800 ohms ±10PCT, 0.5 w, class 2A Carborundum Co. part no. 997E17	714-1724-00
RT2	RESISTOR, THERMAL: same as RT1	714-1724-00
T1	TRANSFORMER, INTERMEDIATE FREQUENCY: 0.490 in. by 0.562 in. by 0.671 in.; Communications Coil Co. part no. X-421-1	278-0660-00
T2	TRANSFORMER, INTERMEDIATE FREQUENCY: same at T1	278-0660-00
T3	TRANSFORMER, INTERMEDIATE FREQUENCY: same as T1	278-0660-00
T4	TRANSFORMER, AUDIO FREQUENCY: 0.906 in. by 0.937 in. by 1.093 in. Stancor Electronics, Inc. part no. 31300	667-0053-00
XQ1	SOCKET, TRANSISTOR: 4 contacts spaced on an 0.200 in. dia circle; Elco Corp. part no. 3307	352-9902-00
XQ2	SOCKET, TRANSISTOR: same as XQ1	352-9902-00
XQ3	SOCKET, TRANSISTOR: same as XQ1	352-9902-00
XQ4	SOCKET, TRANSISTOR: same as XQ1	352-9902-00
XQ5	SOCKET, TRANSISTOR: 3 contacts spaced on an 0.200 in. dia circle; Elco Corp. part no. 3307X	352-9903-00
XQ6	SOCKET, TRANSISTOR: same as XQ1	352-9902-00
XQ7	SOCKET, TRANSISTOR: same as XQ1	352-9902-00
XQ8	SOCKET, TRANSISTOR: same as XQ1	352-9902-00
XQ9	SOCKET, TRANSISTOR: same as XQ5	352-9903-00
XQ10	SOCKET, TRANSISTOR: same as XQ5	352-9903-00
XQ11	SOCKET, TRANSISTOR: same as XQ5	352-9903-00
XQ12	SOCKET, TRANSISTOR: same as XQ5	352-9903-00
XQ13	SOCKET, TRANSISTOR: same as XQ5	352-9903-00
XQ14	NOT USED	
XQ15	SOCKET, TRANSISTOR: same as XQ5	352-9903-00
Y1	CRYSTAL UNIT, QUARTZ: CR-56A/U except test drive and markings; Midland Mfg Co. Inc. part no. M9-3677	289-3677-00
Y2	CRYSTAL UNIT, QUARTZ: CR-56A/U except test drive and markings; The James Knights Co. part no. JKAH3W54-101.6667MC	289-3679-00
Y3	CRYSTAL UNIT, QUARTZ: CR-56A/U except test drive and markings; Midland Mfg. Co. Inc. part no. M9-3661	289-3661-00
Y4	CRYSTAL UNIT, QUARTZ: CR-56A/U except test drive and markings; Midland Mfg. Co. Inc. part no. M9-3663	289-3663-00
Y5	CRYSTAL UNIT, QUARTZ: CR-56A/U except test drive and markings; Midland Mfg. Co. Inc. part no. M9-3665	289-3665-00
Y6	CRYSTAL UNIT, QUARTZ: CR-56A/U except test drive and markings; Midland Mfg. Co. Inc. part no. M9-3667	289-3667-00
Y7	CRYSTAL UNIT, QUARTZ: CR-56A/U except test drive and markings; Midland Mfg. Co. Inc. part no. M9-3669	289-3669-00
Y8	CRYSTAL UNIT, QUARTZ: CR-56A/U except test drive and markings; Midland Mfg. Co. Inc. part no. M9-3671	289-3671-00
Y9	CRYSTAL UNIT, QUARTZ: CR-56A/U except test drive and markings; Midland Mfg. Co. Inc. part no. M9-3673	289-3673-00
Y10	CRYSTAL UNIT, QUARTZ: CR-56A/U except test drive and markings; Midland Mfg. Co. Inc. part no. M9-3675	289-3675-00
Y11	CRYSTAL UNIT, QUARTZ: CR-56A/U except test drive and marking; Midland Mfg. Co. Inc. part no. M9-3678	289-3678-00
Y12	CRYSTAL UNIT, QUARTZ: CR-56A/U except test drive and markings; Midland Mfg. Co. Inc. part no. M9-3676	289-3676-00
Y13	CRYSTAL UNIT, QUARTZ: CR-56A/U except test drive and markings; Midland Mfg. Co. Inc. part no. M9-3662	289-3662-00
Y14	CRYSTAL UNIT, QUARTZ: CR-56A/U except test drive and markings; Midland Mfg. Co. Inc. part no. M9-3664	289-3664-00
Y15	CRYSTAL UNIT, QUARTZ: CR-56A/U except test drive and markings; Midland Mfg. Co. Inc. part no. M9-3660	289-3660-00
Y16	CRYSTAL UNIT, QUARTZ: CR-56A/U except test drive and markings; Midland Mfg. Co. Inc. part no. M9-3668	289-3668-00
Y17	CRYSTAL UNIT, QUARTZ: CR-56A/U except test drive and markings; Midland Mfg. Co. Inc. part no. M9-3670	289-3670-00
Y18	CRYSTAL UNIT, QUARTZ: CR-56A/U except test drive and markings; Midland Co. Inc. part no. M9-3672	289-3672-00
Y19	CRYSTAL UNIT, QUARTZ: CR-56A/U except test drive and markings; Midland Mfg. Co. Inc. part no. M9-3674	289-3674-00
Y20	CRYSTAL UNIT, QUARTZ: CR-56A/U except test drive and markings; Midland Mfg. Co. Inc. part no. M9-3666	289-3666-00
Y21	CRYSTAL UNIT, QUARTZ: 26.900 mc frequency, series resonance, fundamental mode of operation, 3rd overtone; Midland Mfg Co. Inc. part no. M04465	290-4465-00

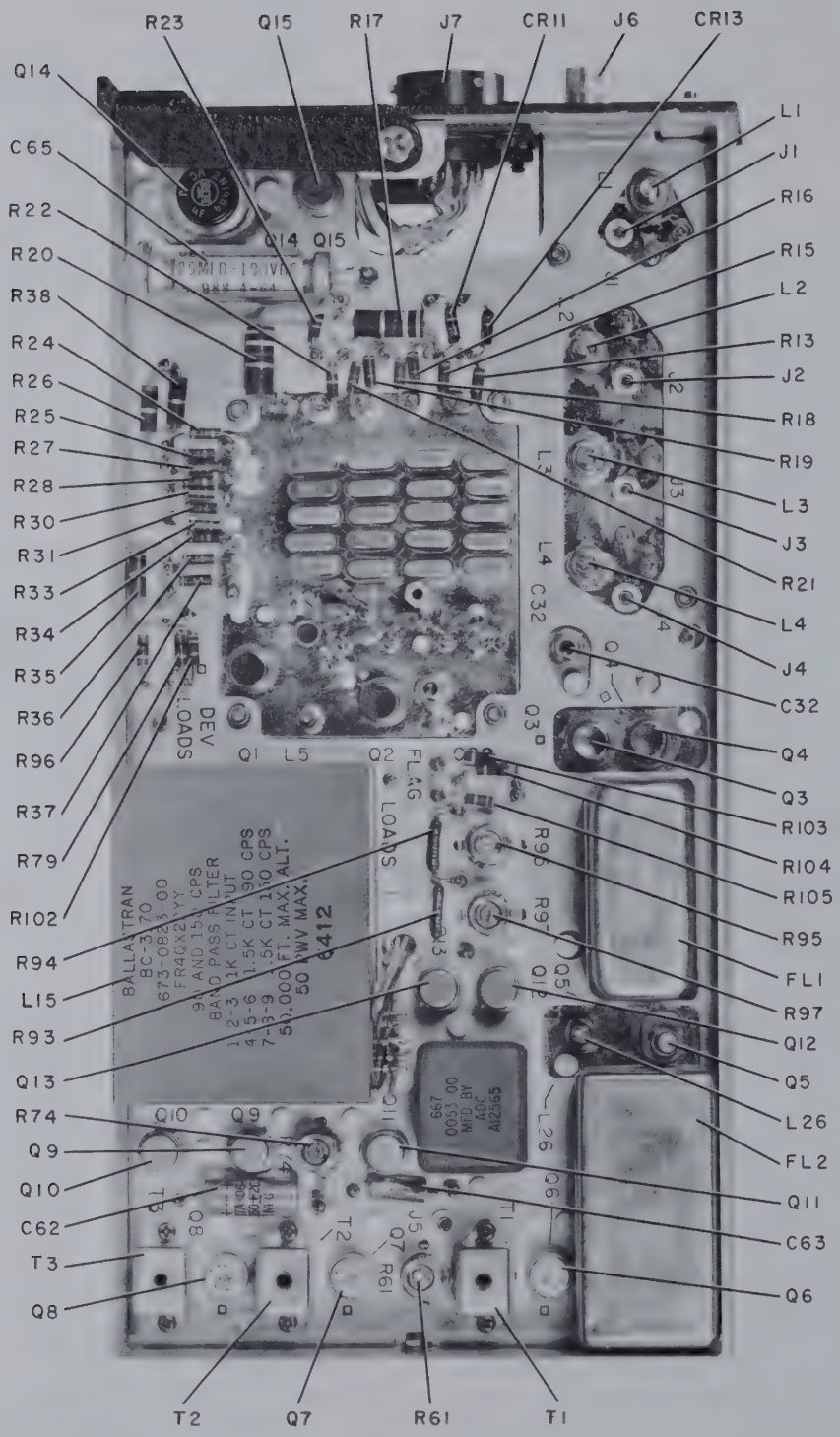


Figure 6-1. 51V-5 Glide Slope Receiver, Parts Location, View 1

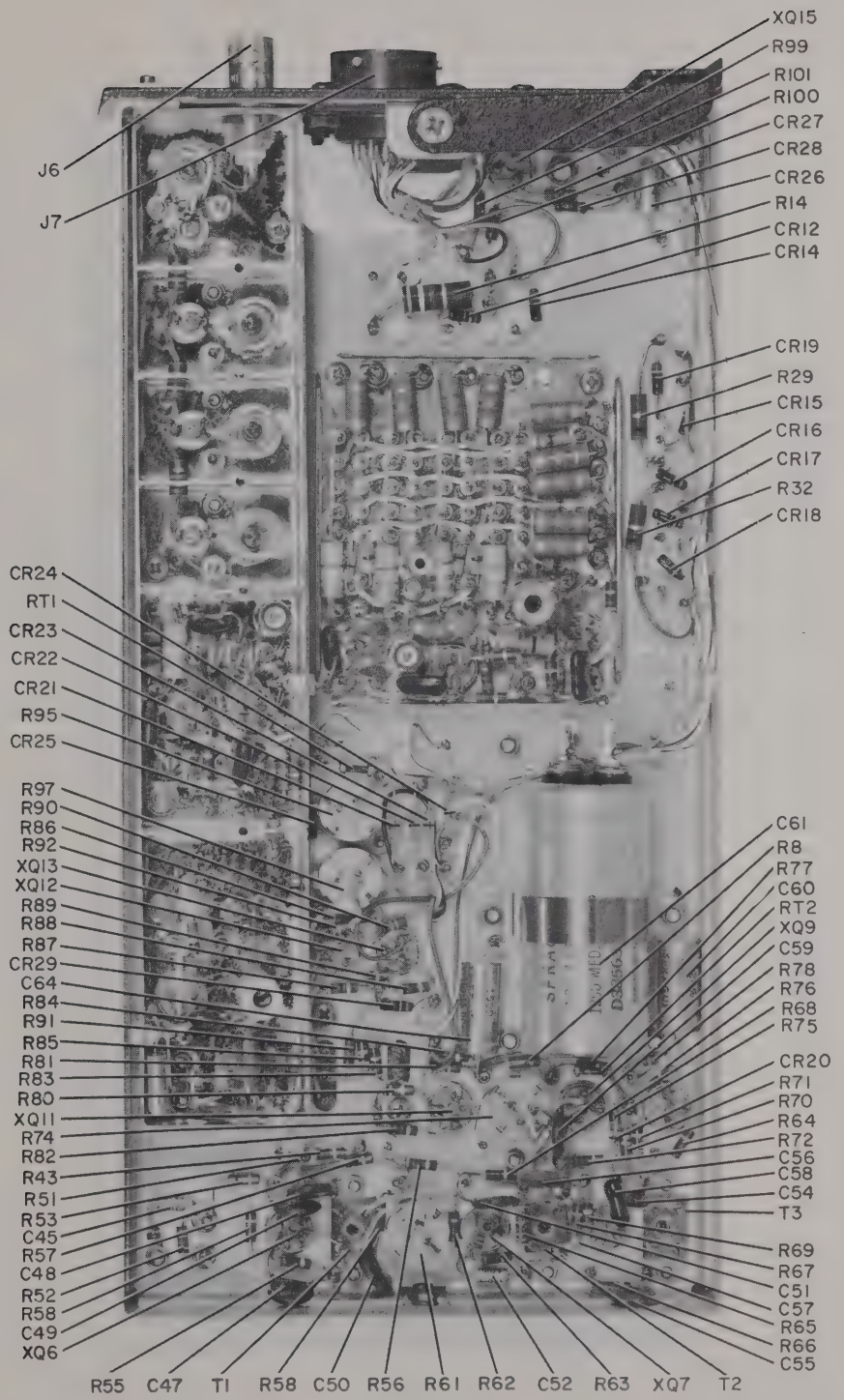


Figure 6-2. 51V-5 Glide Slope Receiver, Parts Location, View 2

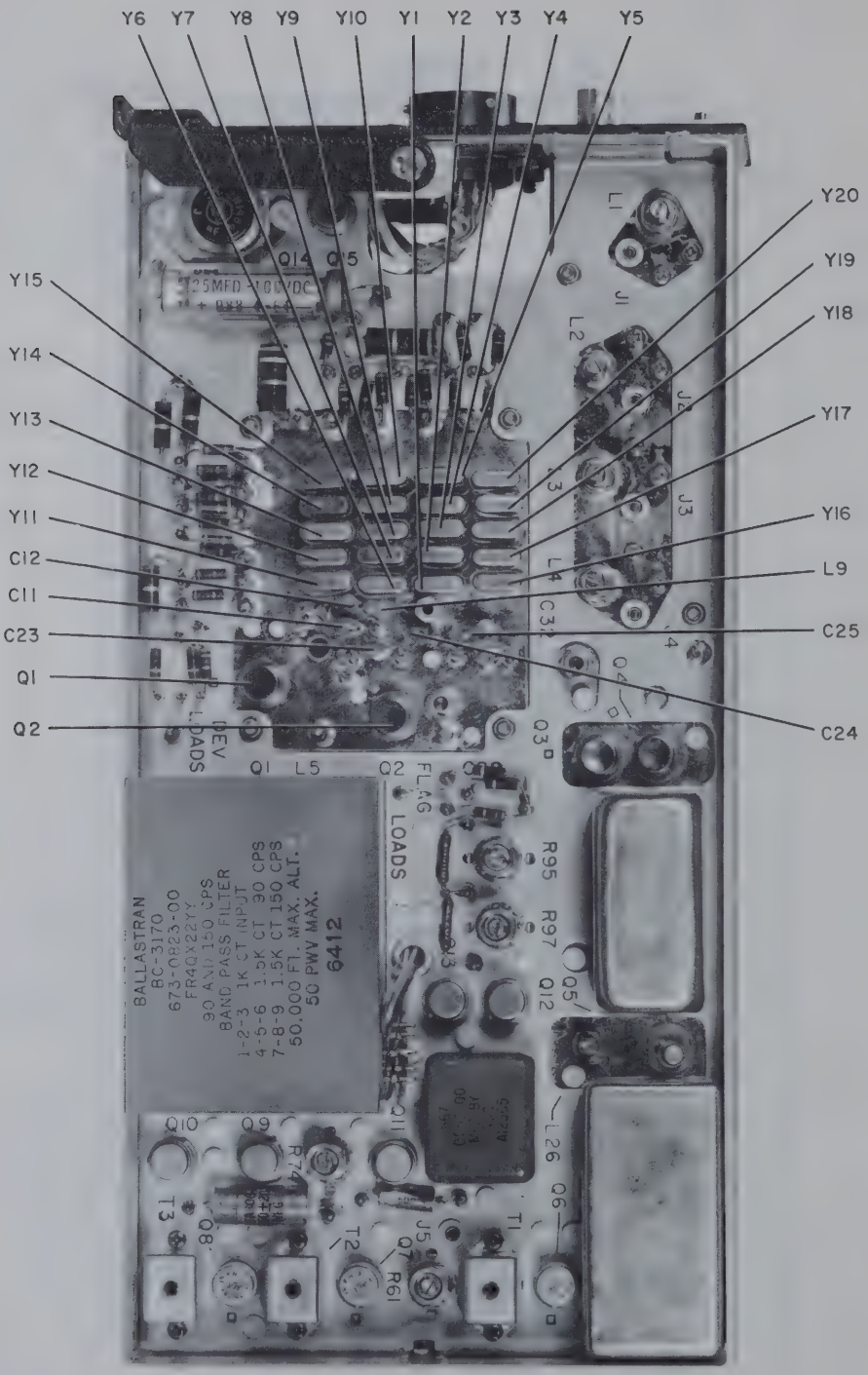


Figure 6-3. 51V-5 Glide Slope Receiver, Parts Location, View 3

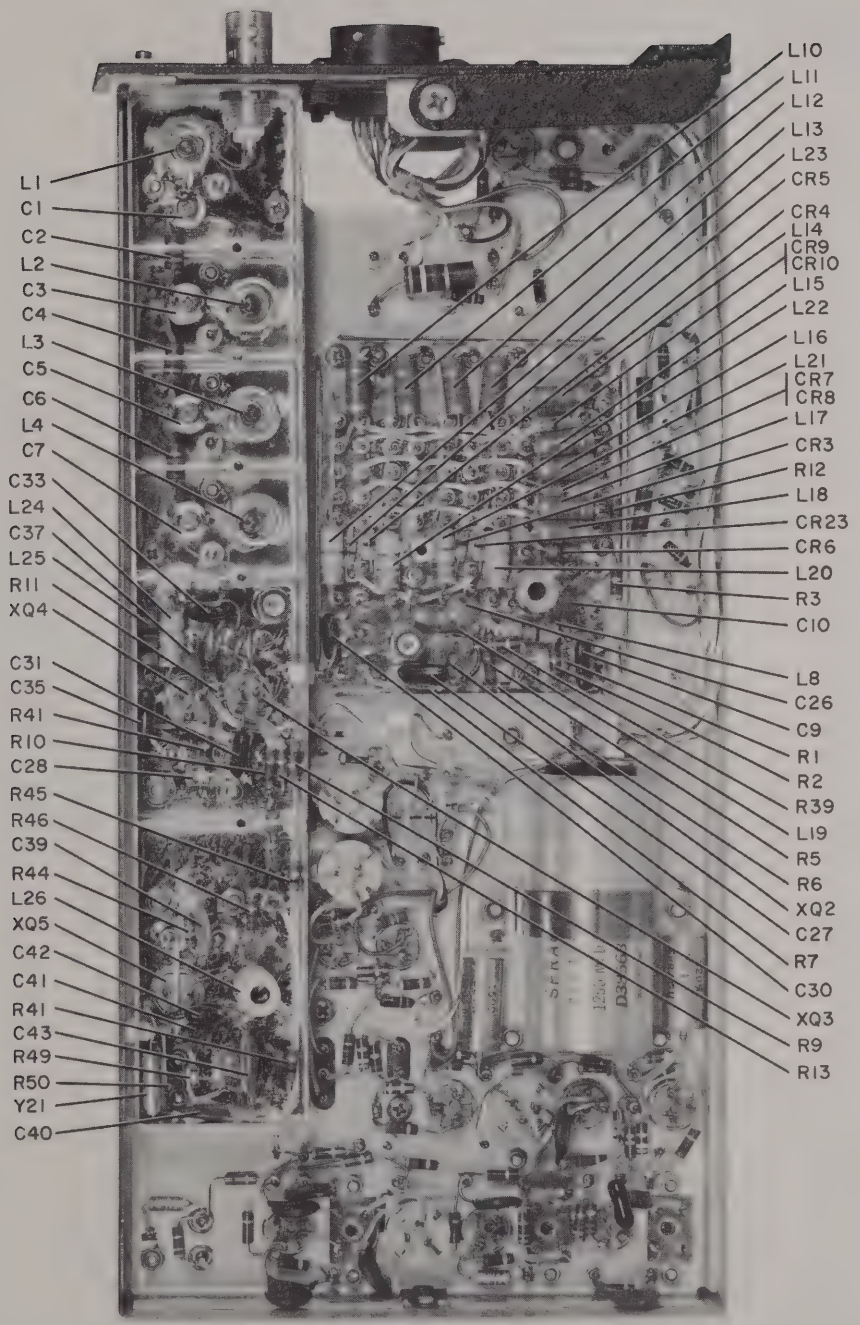
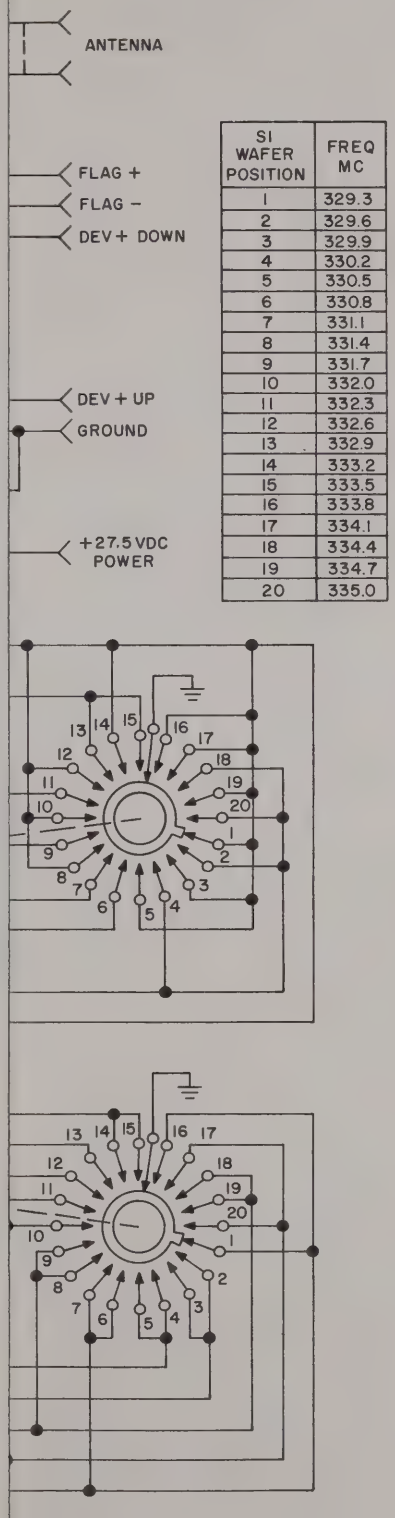


Figure 6-4. 51V-5 Glide Slope Receiver, Parts Location, View 4

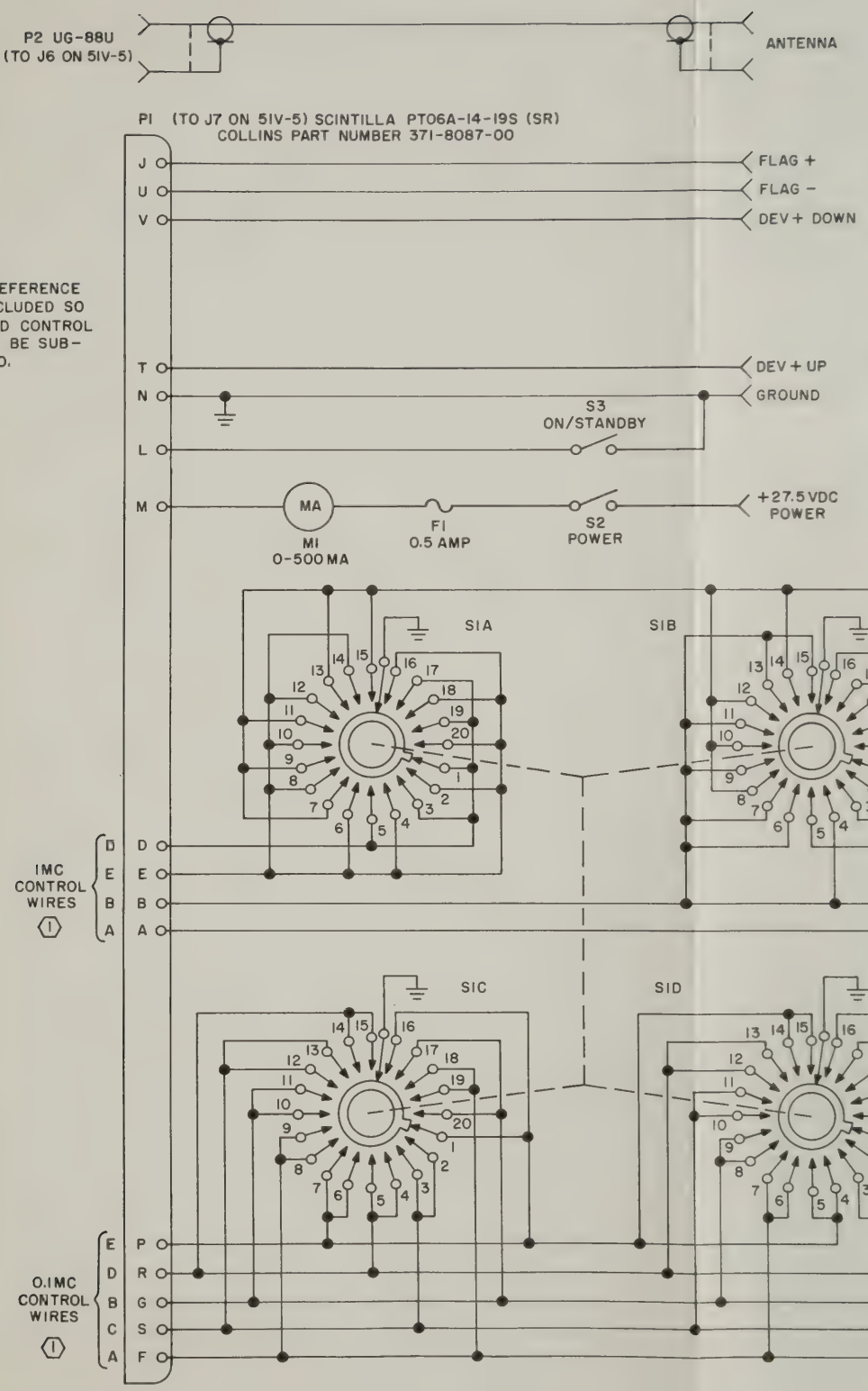
section 7

illustrations



SI WAFER POSITION	FREQ MC
1	329.3
2	329.6
3	329.9
4	330.2
5	330.5
6	330.8
7	331.1
8	331.4
9	331.7
10	332.0
11	332.3
12	332.6
13	332.9
14	333.2
15	333.5
16	333.8
17	334.1
18	334.4
19	334.7
20	335.0

Figure 7-1. 51V-5 Test Fixture, Schematic Diagram



NOTE:

⟨1⟩ ARINC REFERENCE DATA INCLUDED SO STANDARD CONTROL BOX CAN BE SUBSTITUTED.

S1 WAFER POSITION	FREQ MC
1	329.3
2	329.6
3	329.9
4	330.2
5	330.5
6	330.8
7	331.1
8	331.4
9	331.7
10	332.0
11	332.3
12	332.6
13	332.9
14	333.2
15	333.5
16	333.8
17	334.1
18	334.4
19	334.7
20	335.0

Figure 7-1. 51V-5 Test Fixture, Schematic Diagram

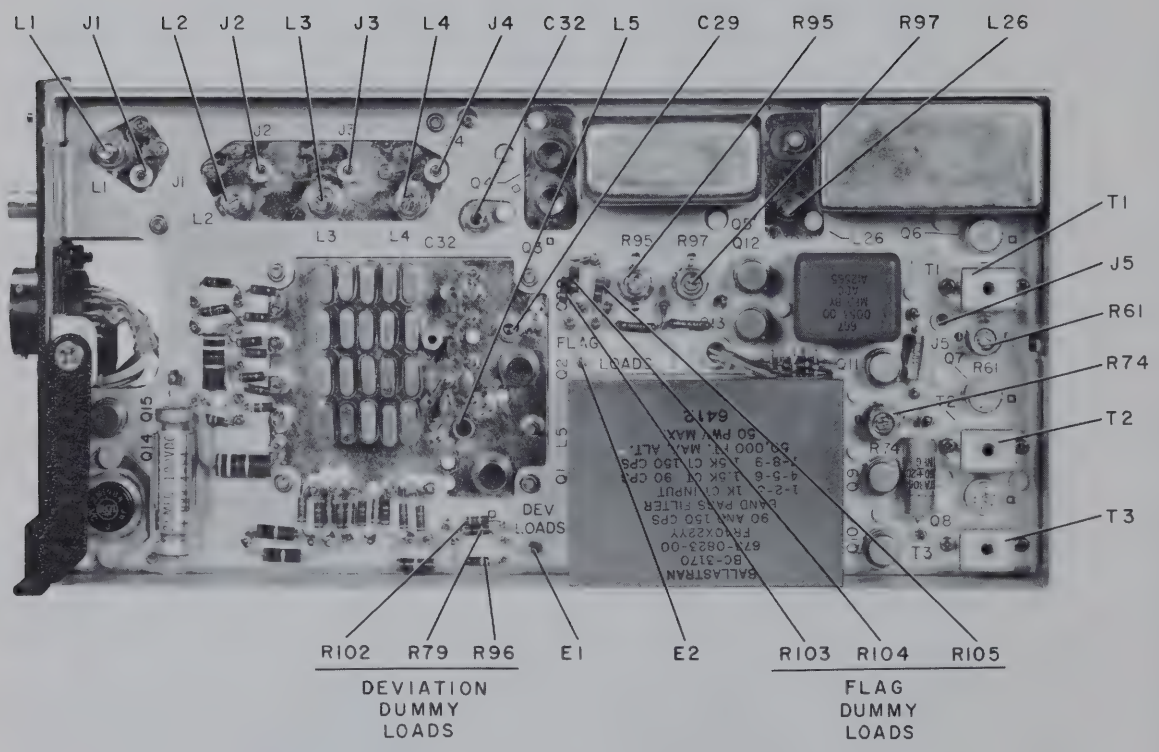
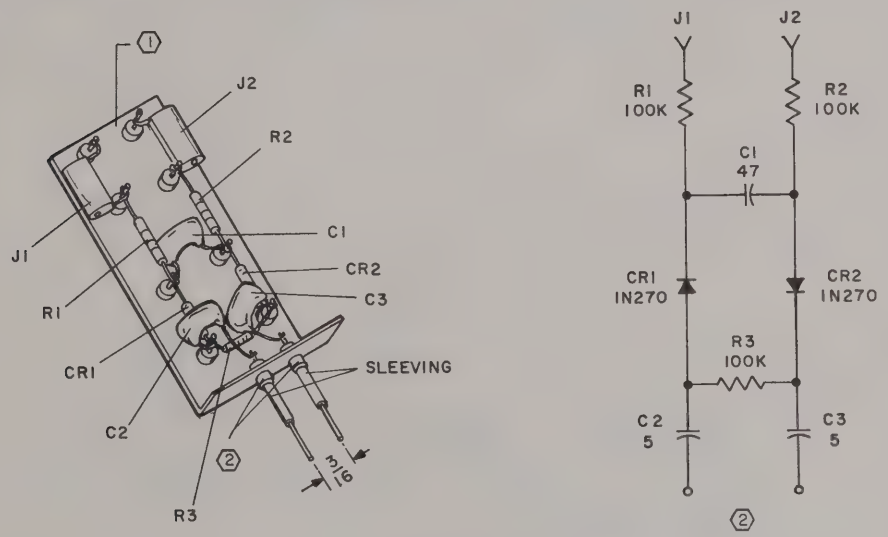


Figure 7-2. 51V-5 Glide Slope Receiver, Test Information

SYMBOL	DESCRIPTION	COLLINS PART NO.
C1	CAPACITOR, 47PF ± 5%	912-2792-00
C2, C3	CAPACITOR, 5 PF ± 5%	912-2750-00
R1,R2,R3	RESISTOR, 100K ± 10% 1/4 WATT	745-0821-00
CR1, CR2	CRYSTAL DIODE .IN270	353-2018-00
J1, J2	JACK, TIP	360-0160-00
TERMINAL (8)	STANDOFF	306-1260-00
TERMINAL (2)	FEED THROUGH	306-1270-00



NOTES.

(1) COMPONENTS ARE PLACED ON A $2\frac{3}{4}$ X 1 INCH ALUMINUM SHEET WITH $\frac{1}{2}$ INCH AT ONE END BENT 90°.

(2) SOLDER TWO $\frac{1}{16}$ INCH BRASS TUBES TO THE FEED THROUGH TERMINALS.

Figure 7-3. Oscillator Tuning Probe, Schematic Diagram

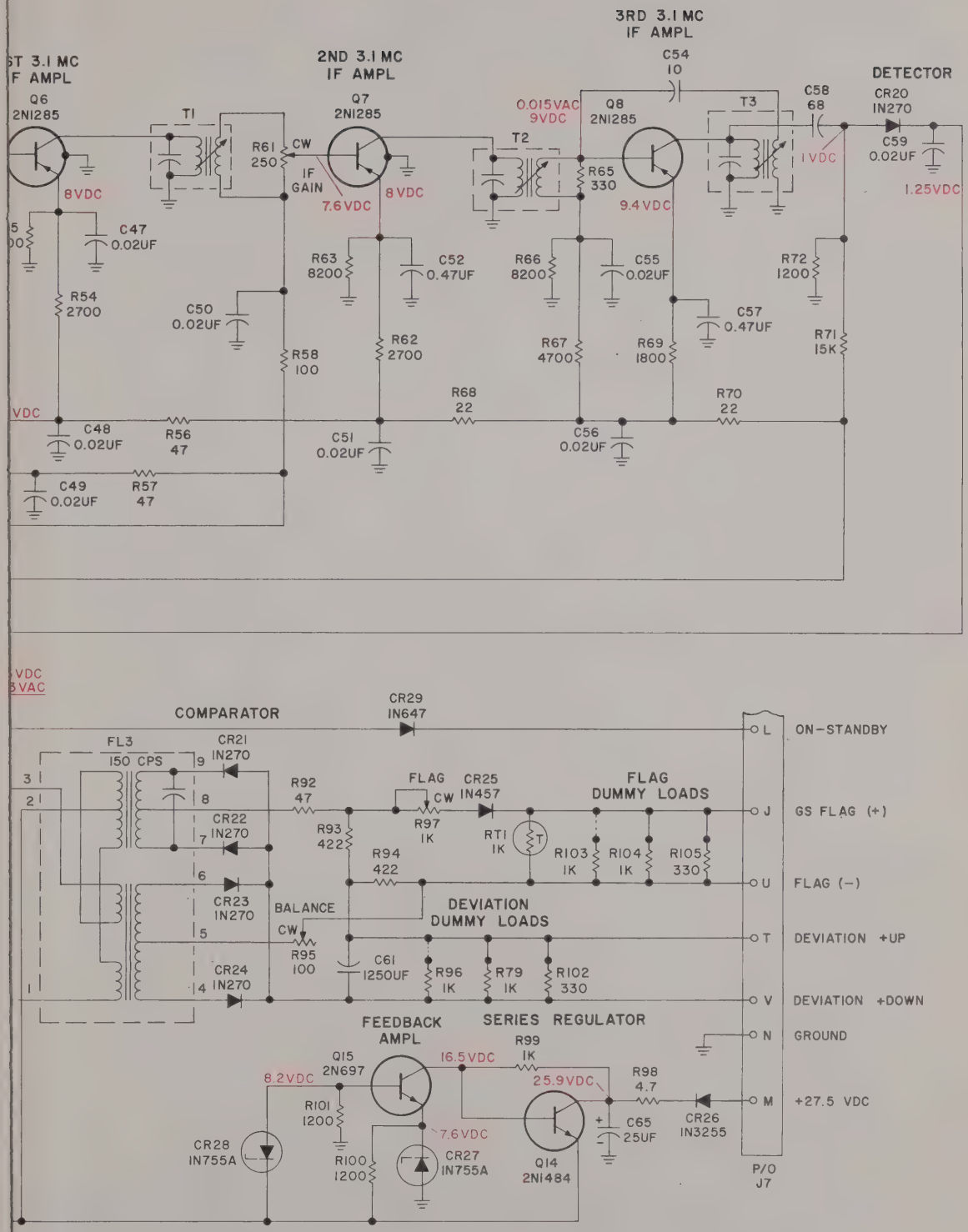


Figure 7-4. 51V-5 Glide Slope Receiver, Schematic Diagram

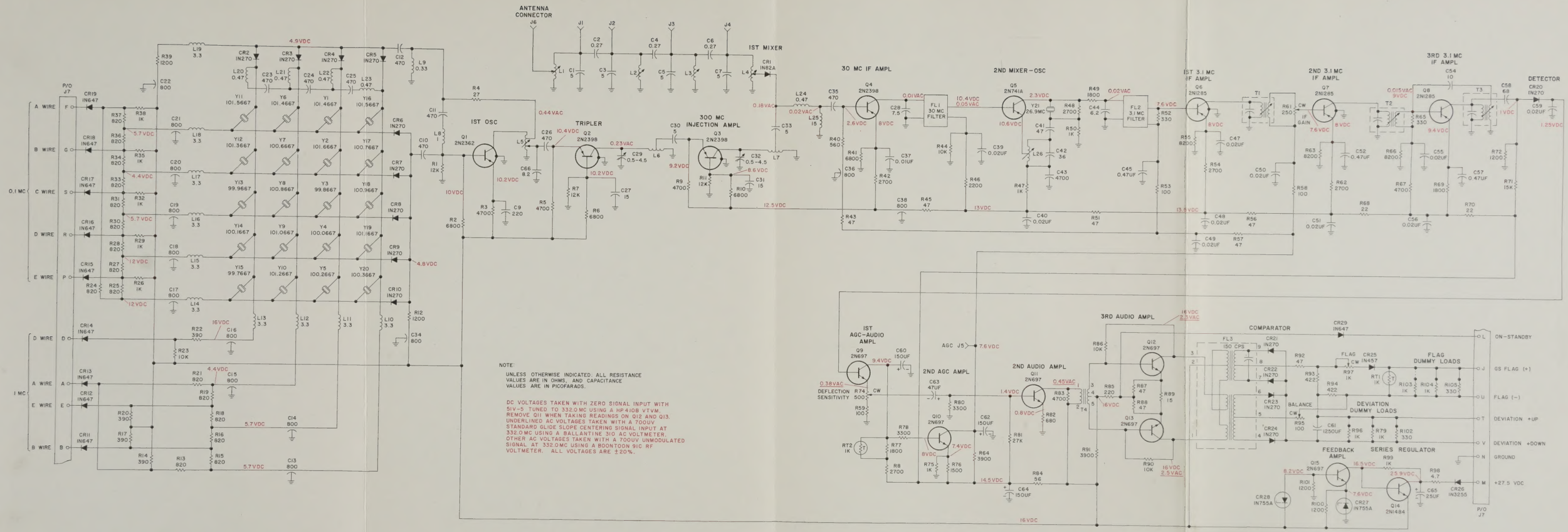

ANTENNA CONNECTOR
IST MIXER
IST OSC
TRIPLER
300 MC INJECTION AMPL
30 MC IF AMPL
2ND MIXER-OSC
IST 3.1 MC IF AMPL
2ND 3.1 MC IF AMPL
3RD 3.1 MC IF AMPL
DETECTOR
IST AGC-AUDIO AMPL
2ND AGC AMPL
2ND AUDIO AMPL
3RD AUDIO AMPL
COMPARATOR
FEEDBACK AMPL
SERIES REGULATOR
FLAG DUMMY LOADS
DEVIATION DUMMY LOADS
ON-STANDBY
GS FLAG (+)
FLAG (-)
DEVIATION +UP
DEVIATION +DOWN
GROUND
+27.5 VDC
NOTE:
UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, AND CAPACITANCE VALUES ARE IN PICOFARADS.
DC VOLTAGES TAKEN WITH ZERO SIGNAL INPUT WITH 51V-5 TUNED TO 332.0 MC USING A HP 410B VTVM. REMOVE Q11 WHEN TAKING READINGS ON Q12 AND Q13. UNDERLINED AC VOLTAGES TAKEN WITH A 700UV STANDARD GLIDE SLOPE CENTERING SIGNAL INPUT AT 332.0 MC USING A BALLANTINE 310 AC VOLTMETER. OTHER AC VOLTAGES TAKEN WITH A 700UV UNMODULATED SIGNAL AT 332.0 MC USING A BOONTOON 91C RF VOLTMETER. ALL VOLTAGES ARE ±20%.

Figure 7-4. 51V-5 Glide Slope Receiver, Schematic Diagram

COLLINS